REPORT OF THE FORESTER.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., October 4, 1923.

SIR: I have the honor to transmit herewith a report of the work in the Forest Service for the fiscal year ended June 30, 1923.

Respectfully,

WILLIAM B. GREELEY,
Forester.

Hon. HENRY C. WALLACE,
Secretary of Agriculture.

NATIONAL FOREST POLICY.

Since last year's report the condition of the country in the matter of its forests has become still clearer. A new study of the whole situation made by the Forest Service revealed more definitely how the public policy should be shaped. Two national problems are involved—land use and timber supply. Down to about 1880 land clearing for agriculture more than kept pace with lumbering, but since that time virgin forests have been cut off under the tremendous demand of a vigorous, growing, and increasingly industrialized Nation much faster than the advance of farming could convert the stump lands into cultivated fields. Except in the South and West, in the last census decade the area of improved farm land was either practically stationary or decreasing. Lumbering adds to the cut-over area at the rate of about 10,000,000 acres a year, but what of this goes into farms is almost offset by abandonment of cultivation elsewhere. Eighty million acres of idle land not in demand for agriculture have become a dead weight on the regions in which they have accumulated.

On the other hand, the eastern and most populous part of the country has already begun to suffer the pinch of timber scarcity and high lumber prices in consequence of forest depletion. The remaining virgin timber in the South and far West still enables us to meet our needs for high-grade lumber, but at a steadily rising cost. Second-growth eastern forests eke out the supply; but we are draining our forests, East and West, of a total of 25,000,000,000 cubic feet of wood annually, while growth replaces only 6,000,000,000. Our future needs must be met from our own forests, and substitutes and economies in utilization will only partially offset the normal increase in demand as population increases. We should, if possible, produce permanently as much wood as we now require. The present

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annual growth could be increased to about 14,000,000,000 feet, or a little over half our present requirements, if all our forests were given adequate protection against fire and elementary practices of forestry were introduced. By intensive forest management, comparable to the best European practice, our total area of forest land could be made to grow 27,000,000,000 cubic feet annually, or enough to take care of our present consumption and afford a little surplus.

The agricultural needs of the country will not make necessary the decrease of our present forest-land area of 470,000,000 acres in order to produce food. This land should be brought under management and, where necessary, reclaimed through reforestation as quickly as possible, since at best the country must pass through a considerable period of timber scarcity before new stands of merchantable size can be grown on the cut-over lands.

Recents developments in Canada raise the problem of timber supplies from another angle. In June, 1923, the Canadian Parliament amended the export act to authorize the Governor in Council to place an embargo upon the export of pulpwood from privately owned lands in the Dominion. This authorization, if carried out, would extend to all privately owned lands the embargo now in effect upon the Crown lands of several of the Canadian Provinces most important to the United States from the standpoint of pulpwood supply.

Imports of pulpwood from Canada for a number of years have normally exceeded 1,000,000 cords out of an average annual consumption in the United States of 5,400,000 cords during the past five years. An embargo upon Canadian pulpwood would be serious because the paper-mill capacity in the Northeast and the Lake States exceeds the existing supply of domestic timber. The action taken by Canada is simply another indication of the growing stringency of timber supply in North America.

As a result of the threatened embargo, the pulp and paper industry has requested the Forest Service to make a survey of the raw materials available for the paper industry in the United States. An important feature of this survey is to determine our resources for growing pulpwood, with a view to creating a perpetual source of raw material on American soil.

With only about 21 per cent of the country's forest lands in public ownership, a number of the States, as well as the Federal Government, are moving for the extension of publicly owned forests. Already 200 municipalities, including cities, towns, and counties, own approximately 450,000 acres of forest land, held primarily for water supply and to a limited extent for timber growing and recreational purposes. Nineteen States have established State forests, totaling about 5,500,000 acres, of which New York has nearly 2,000,000 and Pennsylvania slightly over 1,000,000 acres. For the purchase of State forests, New York in 1916 authorized a bond issue of $7,500,000, and in Pennsylvania a bond issue of $25,000,000 for the same purpose is proposed.

The State of Washington has just adopted a unique purchase method, which is self-supporting, in that the bonds, designated as State forest utility bonds, which are authorized to be issued for the purpose, impose no general obligation on the State as to either principal or interest. Forest lands can be acquired either through exchange

for such bonds or by purchase with the money derived from the sale of bonds, and the bonds can not mature before the time necessary to grow a merchantable forest on the lands acquired. Washington has also adopted the policy of designating as State forests the land it now owns suitable chiefly for the production of timber, which totals about 800,000 acres.

In Indiana a beginning has been made through the establishment of a contingent fund for various public-forest activities, including the purchase of land for State forests, the fund being used only upon the authority of a committee composed of the governor and certain members of the legislature.

While these and other States are going forward in the extension of public-forest ownership, the National Government is lagging behind. The purchase of less than 81,000 acres under the Weeks Act during the year marked the lowest ebb in Federal acquisition of forest lands since the policy was initiated in 1911, with the exception of one year during the World War. Over 4,500,000 acres should be acquired to complete the program of protection on the watersheds of navigable streams which has been approved by the National Forest Reservation Commission. There is also a strong demand that the Federal Government blaze the path of forest restoration in the big black belts of denuded land, where tree planting must be employed extensively, by acquiring key areas as national forests. Public sentiment is urging more and more that the National Government assume a larger direct part in reforestation, by the acquisition of land where reforestation is difficult or costly or where timber production can be combined with the protection of valuable sources of water.

Private forest owners are giving more and more attention to the growing of timber. Particularly is this so in the Northeast, where economic conditions are the most favorable and protection against forest fires in general the most complete; and it is true not only of the large timber tracts but also of the farm woodlands, which comprise about one-third of our total forest area. Owners of cut-over pine lands in the Southeast are beginning to appreciate the possibilities for satisfactory returns from their second growth, and there is a distinct movement initiated by lumber companies to solve their cut-over land problem by classifying the lands and growing timber crops on those not suited for farming.

In order to place the timber supply for its business on a permanent basis, a large manufacturing company has recently purchased several hundred thousand acres of forest land in Michigan and Kentucky. While harvesting the mature crop of timber, this company is leaving the young trees and protecting the lands cut over.

Lumber companies producing 65 per cent of the cut of redwood in California have initiated a system of reforesting their logged-off lands in which young redwood trees grown in nurseries will be planted to the extent necessary to supplement natural reproduction.

Recent years have seen a considerable expansion in the scale of forest-tree planting. The stimulus has been supplied very largely through the policy adopted by some of the States of distributing young trees. Twelve of the States maintain forest-tree nurseries, which grow, in addition to the stock for planting on State-owned lands, about 12,000,000 trees for distribution yearly to private own-

ers. New York has the largest forest-tree nursery in the United States; this and two other nurseries have a combined yearly capacity of 15,000,000 young trees ready for field planting. Pennsylvania distributes to private owners about 4,000,000 trees annually at a low charge.

The farm woodlands represent a great opportunity for development under modern extension methods. Already enough has been done to demonstrate that farm-raised timber is capable of taking a place of importance alongside of other agricultural crops. This is especially apparent when it is realized that forest land on farms aggregates 150,000,000 acres, or about one-third of the total forest area of the United States.

The extension service of the Department of Agriculture has developed through its county agricultural agents and local project leaders an educational machine which spreads like a vast network over the entire country. It comes in intimate contact with a large percentage of the woodland owners, and because of the character of the organization makes possible the widespread influence of a comparatively few leaders.

Extension methods should increase the volume of timber produced, and within a comparatively few years, through practicable methods of conservative cutting, they should materially improve the quality of farm-grown timber. Hand in hand with increased production there must develop a service dealing with the values of timberland products and suggestions for more satisfactory marketing. Such a program gives promise of increasing the annual returns to the farmer and greatly relieving the impending timber shortage.

There has been a rapid rise in the value of timber in the United States, particularly in the Eastern States, whose virgin stands are largely depleted. The commercial pressure for timber growing is steadily becoming stronger. Many indications point to the conclusion that timber growing as a private enterprise is rapidly becoming feasible in the regions more accessible to the principal markets and having favorable natural conditions as to the rate of forest growth and the cost of securing it. In these regions, which ultimately will embrace the greater part of the forest lands in private ownership, there is no necessity for the assumption of timber growing as a public activity in any wholesale way. It will be the wiser course to give free play to the commercial impetus already evident by making the growing of timber a more secure and attractive business.

Organized forest protection with public financial cooperation will greatly reduce one of the principal hazards confronted by the timber grower. An equitable adjustment of taxes on growing forests will reduce or at least more exactly define a second handicap which now deters many business men from commercial reforestation. Forest planting is seriously held back by the lack of nursery stock available at costs which justify its use on a large scale, a lack which public agencies might well supply. The development of technical forestry practice adapted to the enormous range of conditions in the United States by research and its dissemination among the timber growers or possible timber growers of the country will meet another real need of the present situation. It will be the part of wisdom to concentrate public efforts at the present time upon these

obvious measures, which will go far toward bringing up the growth of wood in the United States to a volume more commensurate with our present requirements, together with the extension of public ownership of forest lands in the types and localities where the task is beyond what may reasonably be expected of private ownership.

Federal legislation covering these four or five essential points was proposed during the last Congress and received the indorsement of the President. The nation-wide inquiry now being conducted by a select committee of the United States Senate not only has been fruitful in bringing out the specific forest conditions and problems in the several regions, but also has brought to light in a striking fashion the extent to which many owners of timberland in nearly all parts of the country are ready to engage in the business of growing timber, if public aid can be extended in the protection of forest lands from fire and in the adjustment of forest taxes. The investigation conducted by the Senate committee is one of the most helpful and stimulating steps that the National Government has taken in attacking the reforestation problem of the United States as a whole, and it is disclosing beyond doubt or question that the time is at hand for enormous progress in timber growing if public agencies will give the landowner a fair chance. This should be the aim of the next step in our national forestry policy.

FORESTRY IN ALASKA.

The use of the timber resources of the national forests in Alaska has been increasing as the forest industries of the Territory have steadily developed. There was cut under commercial sales on these national forests during the calendar year 1921, 14,316,000 board feet of timber; during the calendar year 1922, 23,943,000 board feet; and during the first half of the calendar year 1923, 18,809,000 board feet, with every indication that the cut for the full calendar year will largely exceed that of any previous year. Not only has the cutting of national forest timber for local use been increasing, but there has been a continuation of the export of the better grades of lumber to the markets of the United States, to Australia, and to Europe. The small pulp mill already built on the Tongass Forest resumed production in 1922, and has been making frequent shipments of pulp to paper mills in Washington and California.

At the close of the fiscal year the Forest Service was advertising for sale 334,000,000 cubic feet (equivalent to approximately 2,000,000,000 board feet) on the Tongass National Forest in response to an application from a firm which proposed to build a pulp mill on Thomas Bay, utilizing one of the best water-power sites in southeastern Alaska. A satisfactory bid and deposit were received from the applicant, and the timber has been awarded under a contract which requires the construction within the next two years of a pulp or paper mill of at least 100 tons daily capacity.

The preliminary examination of the water-power resources of the Tongass National Forest, in cooperation with the Federal Water Power Commission, was completed, and a bulletin is ready for publication which will make available in convenient form the known data on the water powers of the Tongass Forest suitable for the manufacture of pulp and paper. Water powers in addition to those

already examined are certain to be discovered, but it is already known that over 400,000 horsepower, in units up to 32,000 horsepower, awaits development. The Forest Service has in preparation a companion bulletin which will likewise make readily available the data on the timber resources tributary to these water powers.

The steady development of the use of the Alaskan national forests is in keeping with the Alaskan program enunciated by President Harding this summer. After he had personally investigated conditions in the Territory, he summarized his conclusions in a speech at Seattle, expressing his conviction that Alaska is growing normally, with the kinds of population, industries, and social conditions which will bring a permanent prosperity rather than a temporary boom with quick exhaustion. He recognized that the development of Alaska is an economic process, and that the rate of development depends on the world's markets for the products of the Territory. No panacea, he declared, can bring sudden or magical industrial development. He considered Alaska as an integral part of the United States, to be developed in harmony with our political and social traditions and in harmony with our national policies as to natural resources, and was convinced that under the wise application of those policies a considerable part of the Territory should be ready for statehood at no distant time. President Harding pronounced himself in favor of a continuation of sympathetic administration of Federal affairs in the Territory, with the local officers given as much authority and responsibility as possible in carrying out the coordinated general policies of the National Government. He specifically approved the present policies for the development of industries based on national forest timber, since they offer every reasonable encouragement to capital and involve limitations only to the extent necessary to insure permanency and the sustained productivity of the forests. Concerning the present form of timber contract offered prospective pulp and paper manufacturers he said: "I venture, with some knowledge of conditions in paper-making countries, to state that no better contract, indeed none so good, can be secured in any of them."

THE PERSONNEL OF THE FOREST SERVICE.

It is necessary again, as in several previous reports, to call attention to the nature and importance of the problem that the Forest Service still encounters in the matter of personnel. This problem concerns particularly the field force. For the efficient discharge of its public responsibility in national forest administration the service must have a capable, trustworthy, and trained corps of forest officers. Not only must they be carefully selected and specially qualified for unusual, exacting, and varied tasks, but they must also, as a body, possess enough experience to give continuity and stability of policy, and they must be thoroughly imbued with the spirit of public service.

The work of administration simply can not be carried on in the long run without a forest personnel of suitable make-up. If it is a shifting, unseasoned force, if its members do not measure up to high standards in ability and character, if they have not been well trained for their specific tasks, and if their morale is not kept up, the whole national forest enterprise is impaired.

It is not merely that a field force lacking in competence, experience, or fidelity and enthusiasm will be relatively ineffective, nor is it sufficient to say that the field men are the men with whom the public primarily deals and through whom the system of regulation is applied, and that therefore inefficiency at this point is particularly serious. The question is not one of a greater or less degree of efficiency, but of success or breakdown in a vital matter. With poor forest officers the whole system of administration will fail to secure the necessary public approval and cooperation. The national forests can not be run on bureaucratic lines. While their use must be governed by sound technical knowledge, it must equally meet and satisfy community needs and demands. The forest officer must be able to command the confidence as well as the respect of his local public in order to accomplish his task, and while applying the principles and maintaining the standards prescribed for him by his superiors, he must win approval and support for the undertaking in his hands or he will be the resident representative of a distant and impersonal bureaucracy which does not serve but rules. National forest administration must be a success on the ground and in the judgment of those who come into first-hand contact with it.

The public expects, and in the nature of the case has a right to expect, much of the forest officer. In its eyes he is first and foremost a business man. He must be able to deal understandingly and tactfully with the users, who correspond to the customers of a private concern. He must also be able to plan, direct the work of others, and get results. He must not lack in firmness on occasion, and must be a good negotiator. With tact and sound judgment he must above all combine unimpeachable integrity. The receipts for use of the forests now bring in over $5,000,000 annually, with operating expenses nearly the same, and the total disbursements, inclusive of road building by the Forest Service and other improvement activities, exceed $7,000,000 annually. Forest officers have therefore large financial responsibilities. Their decisions affect the interests of a multitude of individuals. The number of transactions in connection with uses of the forests involving money payments to the Government runs between 60,000 and 70,000 a year. Obviously, the men who make these decisions and conduct these transactions must be beyond influence by favoritism or thought of possible gain for themselves.

On the technical as distinguished from the business side of their work there are further requirements. Their performance as technical men can less readily be judged by the public, but it is not less important to the public, for on it depend the permanence and maximum future productiveness of the forest resources. It concerns efficient and economical protection of the timber growth against fire and other destructive agencies; its renewal and improvement through right methods of cutting; the perpetuation and improvement of the forage resources under intensive range use; the protection of water sources, a fundamental matter affecting all forms of use; intelligent, sympathetic, and skillful coordination of the varied services of the forests to a multiplicity of local needs—to settlers and farmers, stockmen, miners, rural and urban population requiring recreation opportunities, tourists, all sorts of business enterprises, community interests in road and trail development, etc.; and the conservation of fish, game, and other wild life. Nor is this all. The duties of

forest officers as technical men include also leadership in informing the public concerning the purposes and methods of the work, both in order that the public may be able to judge intelligently whether or not its property is being well handled and in order that wide application of the principles of forest and range conservation may be brought about off as well as on the forests. In short, the requirements along technical lines are no less important and exacting than those which forest officers must possess as business men.

To maintain a field force capable of giving the public the service that it expects and should have has always been a primary concern of the Forest Service and always will be. In many ways the task is essentially the same as that which any large business organization encounters in maintaining an efficient personnel. Were this all that is involved there would be no particular reason for dwelling on the subject. But the problem is not purely an internal one, for the reason that it can not be adequately met without relief from conditions that can only be dealt with through legislation.

For years there has been a continual drain of experienced and the most effective men, due to low pay. The Forest Service has been a training school and recruiting ground for private enterprises. To some extent this is bound always to be the case, and within reasonable limits affords no ground for concern. It is not to be expected that Government employment will hold permanently all whose retention in the public service would be advantageous. But conspicuous underpayment in comparison with the responsibilities involved and what may be termed the going market value of the type of men and kind of training required has really serious consequences. It is uneconomical in the long run, for it takes both time and money to select and train new men constantly for positions in which they can not at once reach a full output; it impairs efficiency, for the same reason; and it makes much more difficult the maintenance of morale, which can not but suffer if too large a part of the force is new, while the enthusiasm and energy of older members are sapped by a sense of injustice, lack of due recognition, and often struggle to make ends meet.

The essential remedy is the carrying through of reclassification of all field positions along such lines that the salaries to be paid will be adequate and just, and provision for the actual payment of such salaries next year.

The handicap imposed through inability to hold good men to the degree necessary for efficiency (and in the long run for economy, too) is made worse by the fact that the Forest Service is at present unable to give field men such training in the technical features of their work as they need to do that work properly. It is sometimes assumed that when new men are taken on through appointment following a civil-service examination they must be fully qualified to meet all the requirements of their jobs, and that additional specialized training beyond that gained in the course of the day's work need not be given them. The assumption is untrue. Not only is specialized training of a kind not to be obtained outside the service necessary to fit recruits fully for their duties, but there is need also to fit those in the lower ranks of the service for higher positions. Something broadly comparable with the methods of training and instruction provided in the Army should be permitted. The immediate

need is for annual instruction camps for the training of rangers in the things they need to know how to do in order to handle successfully their own jobs in fire protection and general administration.

There is also a handicap imposed by the fact that the appropriations now made for the Forest Service preclude the taking in each year of more than a very few men technically trained in forestry and grazing. As older men who entered the service with such training leave, the tendency under present conditions is toward a smaller percentage of professionally trained foresters in the administrative force. Such a tendency, if continued, can not but lower the standards of work. Already the situation is distinctly disadvantageous. Enlargement of the available force of trained specialists is therefore an immediate need.

As the demand for the timber and forage of the national forests increases more and more intensive use will be necessary, and professionally trained men will be required in correspondingly greater proportion. Nevertheless, for years to come men of outstanding ability who have entered the Forest Service without professional training should be able to look forward to positions of major responsibility. It would be a great misfortune if this were not true, for the service has need of the best leadership that can be developed from its entire personnel. Some of the highest positions are now held by men who have climbed the ladder from the ranger ranks. They have been progressively educated as foresters in the practical school of experience. Nothing is more fundamental than that the door should be kept open to ability and that the methods of personnel management should be such as to assure both the fullest possible development of the personnel available and, from the standpoint of the men themselves, prospects that encourage ambition and effort. As a corollary to this, there must be absolute assurance that merit alone determines promotion, and that the forest officer who does his work as it should be done, with an eye single to the service of the public interests, will be secure in the tenure of his position, whatever that may be. The public enterprise in forestry can make good only on condition that it be kept always free from influence by political considerations in the narrowest sense of the term, and one of the greatest obstacles to progress in the development of forestry on the part of the individual States is the fact that public opinion does not always demand this essential to the creation and maintenance of an efficient technical organization faithfully serving the common welfare.

As is shown in the next section of this report, the national forests are already virtually self-supporting, and from now on they may safely be counted on to return to the Treasury a net revenue in excess of their operating cost, though no small part of that cost is incurred on behalf of public services of a nonrevenue-producing character, such as watershed protection and recreational use. Further, the cost of maintenance of the regular protective system as well as emergency expenditures for fire fighting are mainly not operating costs, strictly speaking, but charges against the time when the stands of timber in regions not yet opened up will come into demand. Private timberland owners would capitalize such charges as carrying costs. The less-developed forests and those which are maintained primarily for watershed protection and will not be self-supporting for a long time, if ever, create operating deficits which

are at present just about balanced by the net operating revenue obtained elsewhere. In addition, considerable expenditures are made yearly on the forests for their betterment and development in the form of new roads and trails, buildings, range improvements, and investigations looking to larger and more intensive use. The fact that expenditures of this kind, amply justified on business grounds and making possible greater revenues in the future, bring the total expenditures of the Government on the forests approximately a million dollars above the current receipts should not be permitted to obscure the basic situation. The forests carry themselves now as operating public utilities, and in another year or two will more than carry themselves. Under these conditions there is excellent ground for asking the relatively insignificant increases necessary to maintain the personnel whose efficiency directly affects the income from the forests as well as their value to the public.

NATIONAL FOREST RECEIPTS AND EXPENDITURES.

The receipts from the national forests for the fiscal year were as follows:

From the use of timber	$2,721,876.20
From the use of forage	2,341,485.85
From miscellaneous uses, including the use of land, water-power sites, etc	272,456.08
Total	5,335,818.13

A portion of this amount represents grazing fees for the fiscal year 1922 which were collected in 1923 under the deferred-payment system. Since it is probable that an equal amount will be collected in the fiscal year 1924 on account of 1923 grazing fees, the total of $5,335,818.13 may be taken as representing substantially the gross revenue derived from use of the forests for the year covered by this report.

Compared with the actual receipts for the previous year, the total given above shows an increase of about $270,000; but, as was explained in the report for 1922, the showing of receipts from grazing in that year exceeded by almost $800,000 the estimated amount paid or due for the actual use of the range for the period. Deferred payments of grazing fees have affected the receipts statements of the last three years. Previous to 1921 payment of the fee was always made before the stock entered the forests, and the receipts of successive years were comparable. Correcting the figures of actual grazing receipts for the three years 1921–1923 to show as nearly as possible what each year's business should be credited with, they were as follows:

Total grazing fees paid or due for fiscal year 1921	$2,415,618
Total grazing fees paid or due for fiscal year 1922	2,166,347
Total grazing fees paid or due for fiscal year 1923	2,341,486

A corresponding correction of the total of receipts from all sources for the same years gives—

For the fiscal year 1921	$4,468,940.00
For the fiscal year 1922	4,271,902.82
For the fiscal year 1923	5,335,818.13

The high-water mark of receipts prior to 1923 was set in 1920, when the total was $4,793,482. The 1923 receipts, therefore, rep-

resent an actual increase in revenue-producing business over 1922 of more than $1,000,000 and over the previous record year of more than $540,000.

The total was nevertheless below what would have been obtained under normal conditions in the livestock industry. As the grazing business reattains its normal footing, the receipts from this source will be somewhat greater, and there is a certainty of steadily growing receipts from timber sales. As is shown by a comparison of the 1923 receipts with the following statement of expenditures for the same year, the forests are now bringing into the Treasury considerably more than their operation is costing if special expenditures for fire suppression, for improvement construction, and for other activities looking to the betterment of the properties or undertaken in anticipation of future business are excluded.

Approximate expenditure of Forest Service appropriation, 1923.

Protection and administration of the national forests		$5,133,382
Fighting fire which could not be suppressed by the regular protective force [1]		250,000
Classification, survey, and segregation of agricultural land, and accomplishment of authorized land exchanges		60,000
For the construction of sanitary facilities and for fire-preventive measures of public camp grounds		10,000
Planting of 7,500 acres on nonproducing land, maintenance of nurseries, and experiment in tree planting		125,640
Permanent improvements, such as buildings, bridges, trails, telephone lines, drift fences, and water improvements [2]		425,000
Estimating the amount and fixing the minimum value of timber for sale		62,500
Examination of intensively used ranges with a view to increasing their productivity by more scientific management of stock and forage		37,500
Investigations:		
Forest products, including the Forest Products Laboratory at Madison, Wis	$340,000	
Silvicultural	85,000	
Range and forage plants	35,000	
		460,000
Recording, digesting, and disseminating the results of scientific and technical work		31,280
Total		6,595,302

The total given above exceeded that of the previous fiscal year by $46,000, or 0.7 per cent. By individual items the changes from last year were as follows:

For the protection and administration of the national forests	$6,000
For the construction of sanitary facilities and for fire-preventive measures on public camp grounds	10,000
Planting of nonproducing lands, maintenance of nurseries, and experiment in tree planting	5,000
Permanent improvements	25,000
Investigations in forest products	15,000
	61,000
Less decrease for classification, survey, and segregation of agricultural land	15,000
Net increase	46,000

[1] An additional emergency appropriation of $375,000 was required for the purpose.
[2] Of this sum, nearly half is required for the maintenance of existing improvements used in the protection and administration of the national forests.

Expenditures for fire fighting have made deficiency appropriations necessary for 8 out of the last 10 years. Congress has preferred to make a relatively small fund available in advance for meeting fire emergencies and to supply whatever additional amounts were required through deficiency appropriations. This has lessened initial appropriations, but it has had certain drawbacks. It is now urged that fire-fighting deficiencies be met out of regular appropriations. The average cost of emergency fire prevention and suppression paid from the special fund and from deficiency appropriations for the past three years has been $708,000. To cut down the present expenditures on other lines of work during the summer months—the active field season—sufficiently to create the contingent fund required not only would necessitate refusing new timber-sale business but also would cripple the whole administrative and protective organization. In other words, if the necessity of deficiency appropriations in all but the most favorable seasons is to be avoided, the special fire-fighting fund available for meeting emergency conditions should be materially increased.

There is need also for a change in the law that will make the emergency fire-fighting fund available immediately upon passage of the appropriation act. In the average season slightly over $100,000 is spent for spring fire fighting, but if the fire season opens late very little may be required. In the past it has been necessary to guard against being faced with emergency conditions just when there are no longer any funds whatever with which to meet them, by seeking a sufficient deficiency appropriation to afford a margin against contingencies. In effect this amounts to partially replenishing the special fire-fighting fund in years in which it has been exhausted early in anticipation of needs that may not develop. If the emergency fire fighting for the following year can be drawn upon for spring fire fighting, no obligation of Treasury funds for this purpose in excess of actual needs will be required, and no deficiency appropriation will be necessary for anything but expenditures already made.

THE NATIONAL FOREST PROPERTIES.

At the close of the fiscal year the net area of national-forest land was 157,236,807 acres, and the gross area, which includes interior holdings not in Government ownership, was 182,099,802 acres. The net area increased during the year 399,525 acres; the gross area increased 299,805 acres, of which, however, 47,514 acres are represented by recomputations of existing areas based upon more exact surveys and projections.

The total area added to the national forests by Executive orders or proclamations was 408,622 acres. Specifically the additions were as follows: Carson National Forest (New Mexico), 124,247 acres; Fillmore Forest (Utah), 10,268 acres; Lemhi Forest (Idaho), 254,744 acres; Manzano Forest (New Mexico), 16,608 acres; Michigan Forest (Michigan), 435 acres; and Powell Forest (Utah), 2,320 acres. The Lemhi addition was authorized by specific act of Congress as the result of long-continued effort on the part of local residents to have the land placed under national-forest administration. The Powell addition involved a part of the land subsequently embraced within the Bryce Canyon National Monument. The actual eliminations

aggregated 156,331 acres. Of these by far the greater proportion—116,220 acres—were made to clear list lands selected by the States under exchange agreements, as follows: In Montana, from the Blackfeet Forest, 57,198 acres, and from the Flathead Forest, 32,185 acres; in Washington, from the Columbia Forest, 19,018 acres, and from the Colville Forest, 7,770 acres; in South Dakota, from the Harney Forest, 49 acres. The remaining eliminations, amounting to 40,111 acres, were designed either to exclude lands not chiefly valuable for national-forest purposes or to promote the adjustment of valid claims, or, in Alaska, to allow entries under the trades and manufacturers act. Specifically, these eliminations were as follows: From the Angeles (California), 295 acres; the Carson (New Mexico), 10,393; the Fillmore (Utah), 10,161; the Harney (South Dakota), 160; the Jefferson (Montana), 401; the Leadville (Colorado), 1,596; the Lemhi (Idaho), 6,568; the Missoula (Montana), 320; the Powell (Utah), 5,100; the Rainier (Washington), 2,730; the Routt (Colorado), 2,318; and the Tongass (Alaska), 69.

Withdrawals for national forest purposes reached their peak during the fiscal year 1909. There ensued a period of systematic and analytical determination of the value of the reserved lands for forest purposes, with the result that during the past 14 years 26,631,586 acres have been eliminated from the national forests. While the boundary changes were thoroughly effective in excluding from national forests the lands better adapted to other purposes, statutory restrictions generally barred the adding of lands chiefly valuable for timber production. Even to-day many of the present national forest boundaries are unsatisfactory in that they embrace only parts of the natural forest units which, in the public interest, should be under protection and management. Many of the circumstances which formerly precluded additions of unreserved and unappropriated public forest land have lost their importance and there is now no substantial reason why the unreserved and unappropriated public lands chiefly valuable for timber production or watershed protection, estimated at 4,000,000 acres, should not be in national forests. Neither is there any substantial reason of public interest why revested lands aggregating 1,500,000 acres chiefly valuable for timber production should not be in forests. The present status of Indian lands, chiefly valuable for timber production, justifies a separate and somewhat different form of protection and management, even though they do, in many instances, adjoin national forests and form contiguous parts of natural units of tree growth; but when the Indian equities are liquidated and the status of the reservations is changed the unallotted timberlands now comprising parts of such reservations should most emphatically be conserved and protected in the public interest by inclusion within national forests.

The amount available for purchases of lands under the Weeks law was the lowest of any year since the passage of the act; consequently the acreage approved for purchase fell markedly below the levels of previous years. This was unfortunate, as many desirable properties within the boundaries of existing purchase units were available for acquisition at low prices; and if larger expenditures had been authorized, the Government's holdings in the East could have been materially and advantageously increased. The purchase agreements approved by the National Forest Reservation Commission covered

79,923 acres; the total approved price was $347,767.98, and the average price per acre $4.35. This average, while $1.05 above that of the preceding year, is below the average of the total purchases to date and is a low value for the desirable properties involved.

While the approved purchases reflected the current progress of the work, the actual acquisition of land is not accomplished until transfers of title to the Government have been perfected. The lands actually acquired during the year aggregated 142,953.43 acres and cost $652,119.88, or an average of $4.56 per acre. By States they were distributed as shown in the following table:

Acreage of timberland acquired in fiscal year 1923 and total acquired to July 1, 1923, by States.

State.	Acreage acquired in fiscal year 1923.	Average cost per acre.	Total acreage acquired to July 1, 1923.
Alabama	15,568.01	$4.91	79,449.20
Arkansas	12,367.37	3.10	53,206.02
Georgia	3,495.10	6.17	153,458.08
Maine	91.53	6.00	32,255.98
New Hampshire	719.73	6.69	405,068.41
North Carolina	17,656.79	6.97	348,319.96
South Carolina	104.15	5.25	18,558.41
Tennessee	959.04	4.72	241,209.79
Virginia	62,338.54	4.85	431,511.82
West Virginia	29,653.17	2.68	132,108.78
Total	142,953.43	4.56	1,895,146.45

The total cost of all lands acquired has been $10,018,111.38, and the average cost per acre $5.29.

No new purchase units were established during the year, nor were any material changes made in the boundaries of existing units except the Allegheny, in northwestern Pennsylvania, where, with the consent and approval of the State, they were enlarged to embrace an additional 315,000 acres, partly rough slopes adjacent to the Allegheny and Clarion Rivers and partly lands contiguous to the New York State boundary and the Allegheny State Park.

For several years the National Forest Reservation Commission has recognized the need for larger appropriations for purchases to permit a faster consolidation of existing units and also extension of the work into new regions where Federal participation in forest regeneration is most desirable. Of the latter, a number were enumerated in the reports for the two preceding years. The most imperative need for the early establishment of new purchase units is (1) on mountainous watersheds in the Eastern States tributary to our great river systems, and (2) in the pineries both of the Southern and of the Lake States, where stream protection would be combined with the meeting of peculiarly urgent public requirements for the inauguration of measures to restore the forest on extensive areas of denuded and idle land. Public acquisition and reforestation of portions of these pine lands is important, not merely to bring about the reclamation to timber growth of the areas actually taken over, but also to provide practical demonstrations of what can be done in the solution of what are already large regional problems, of national importance and of growing magnitude.

To provide for increased acquisitions, the commission has consistently recommended annual appropriations of $2,000,000, or, in other words, a return to the scale of expenditures established by the Weeks law itself for the first 5 years of its operation. There can be no question of the soundness of such recommendations. The situation requiring constructive action by the Government is growing so rapidly in magnitude and public importance that measures adequate ten years ago now fall far short of the minimum public requirements. Delay will mean an aggravation of the rapid decline in the productive capacity of lands essential for timber production, yet with a probable advance in the prices which must be paid.

In the matter of land exchange, made possible by the passage of the general exchange act of March 20, 1922, and of other more specific measures, the year has been a period of study on the part of both the Forest Service and the owners of the lands subject to the operation of the exchange acts. The Forest Service did not deem it to the public interest to enter upon an extended program of exchanges until the relationship of the private lands to the national forest properties had been fully developed by careful study and sound plans formulated, or, more important still, until bases of valuation capable of economic justification had been evolved. The trend of land values, particularly of the types under consideration, obviously was variable and uncertain, and safety of appraisal lay only in thorough study of the trend in each locality. It has been difficult to reach agreements as to the worth of a number of acceptable properties, and only a few minor exchanges were consummated. The Forest Service, however, enters the new fiscal year with adequate exchange plans for every national forest and with voluminous data bearing on valuations. As the fiscal year came to an end there was increasing evidence that the values placed by many owners on private lands within the forests were gradually coming into harmony with those of the Forest Service, so that while the year ended without much to show in land actually acquired, an adequate and stable foundation was prepared for a program of exchanges based on conservative values.

The outstanding development in the classification of the national forests under the act of August 10, 1912, was the completion of the extensive classification of the Tongass Forest in Alaska. The intensive examination and classification of approximately 200,000 acres in that forest and the extensive and intensive classification of the Chugach Forest, also in Alaska, will complete this work. In the continental United States a few minor errors of classification were discovered and corrected, but appeals from the classification have dropped to a negligible number, and it now seems strikingly apparent that the classification commands full public confidence and is generally accepted as correct and dependable.

Practically all claims initiated prior to the creation of the national forests and almost all the claims initiated under the act of June 11, 1906, have now been adjusted, so that the claims work has dropped to a position of unimportance. The exploitation of mineral resources within the forests continues unabated, but largely under leases or licenses which offer no complicated questions of title or administration.

FOREST PROTECTION.

PROTECTION OF THE NATIONAL FORESTS.

Fires on the national forests in the calendar year 1922 compared in number, size, and causes with those of the two previous years as shown below. In the classification of causes for the 1922 statistics, the fires of unknown causes were thrown under the designation "Miscellaneous," and the old designation of "Campers," under which had been included all fires due to picnickers, fishermen, and other transients, gave away to the more restricted "Camp fires," while a new class was created through provision for recording separately fires traceable to smoking. In comparing the figures for the three years, allowance must be made for these changes.

Comparison of fires on national forests, calendar years 1920, 1921, and 1922.

Classes and causes of fires.	Number of fires.			Percentage of total.		
	1920	1921	1922	1920	1921	1922
Class of fire:						
Burns less than 0.25 acre	3,122	2,947	3,069	51.37	50.37	48.14
Burns between 0.25 and 10 acres	1,724	1,606	1,840	28.36	27.45	28.86
Burns 10 acres and over	1,232	1,298	1,466	20.27	22.18	23.00
Total	6,078	5,851	6,375	100.00	100.00	100.00
Causes of fires:						
Railroads	508	643	381	8.36	10.99	5.98
Lightning	3,082	1,451	2,323	50.71	24.80	36.44
Incendiarism	245	562	870	4.03	9.60	13.65
Brush burning	248	365	236	4.08	6.24	3.70
Campers [1]	1,052	1,738	.....	17.31	29.70	.....
Camp fires [2]	.....	.....	843	.....	.....	13.22
Smokers [2]	.....	.....	1,110	.....	.....	17.41
Lumbering	211	156	156	3.47	2.67	2.45
Unknown [1]	485	674	.....	7.98	11.52	.....
Miscellaneous	247	262	456	4.06	4.48	7.15
Total	6,078	5,851	6,375	100.00	100.00	100.00

[1] Classification discontinued calendar year 1922.
[2] New classifications beginning calendar year 1922.

Calendar year.	Total area of national forest land burned over.	Total damage on national forest land burned over.	Total cost of fighting fires exclusive of time of forest officers.
	Acres.		
1920	342,193	$419,897	$852,338
1921	376,208	212,182	456,099
1922	373,214	494,965	607,200

The 1922 fire season was marked by unusual weather conditions. Fires occurred early in June in most of the districts, and a severe fire season seemed in prospect, but rains and cooler weather in late July and early August afforded a respite. The situation then became critical again. No precipitation of any consequence occurred during September and most of October—a very unusual prolongation of the danger season. In district 4 (Utah, Nevada, southern Idaho, and southwest Wyoming) the heaviest expenditures for fire fighting were in late September and early October. In district 5 (Califor-

nia), however, the peak of the fire season was reached in the last 20 days in September.

In spite of the prolonged dry period, districts 1 and 2, located in the Rocky Mountain region, had the most favorable season in years. On the Pacific coast and in the Southwestern and Eastern States the situation was more difficult than usual. In district 6 (Oregon and Washington) the protective organization was seriously handicapped by the smoke blanket which covered the entire country during the season.

Man-caused fires dropped from 4,400 in 1921 to 4,052. In comparison with the averages for the five-year period 1916–1920, the percentages of fires caused by brush burning, railroads, and lumbering fell, while those caused by campers, smokers, and incendiaries rose. The incendiary fires were chiefly on one or two forests in district 1 and district 7, where some of the settlers are antagonistic to fire control. In most of the districts incendiary fires were fewer. The rapidly growing use of the national forests would naturally lead to many more campers' and smokers' fires; but the outstanding fact is that except for highly localized "sore spots" of incendiarism man-caused fires seem to be decreasing. They are undoubtedly decreasing rapidly in relation to the greater use of the forests for recreational purposes.

The area burned in 1922 was slightly less than in 1921, but the damage to national forest resources more than doubled. This was because of more serious fires in stands of merchantable timber in 1922. The cost of suppressing fires in 1922 amounted to $674,612, as compared to $512,106 in 1921 and $911,476 in 1920.

The 1923 fire season is not yet over, so that statistics covering it can not be given. During the months of May and June the fire situation was extremely critical on the Minnesota forests of district 2 and in district 7. The latter district is experiencing the worst fire season in its history. Most of the fires in Minnesota during May and June in 1923 occurred through the spreading of fires set by settlers and lumbermen in disposing of slash. The months of July and August were extremely favorable, and the indications are now that the season of 1923 for the Forest Service as a whole will be the best since 1916.

Fires which originated on lands outside of the forests were about average in number, but were more than usually extensive and destructive. The hazard created by fires which start in slashings on private lands is always present. Serious losses in property damage and fire-fighting expenditures occurred from this cause in Montana, Arizona, and New Mexico in 1922 and in Minnesota in the spring of 1923. This situation can be met only through cooperation with the operators on private holdings to extend to these outside lands the most effective standards of fire prevention. This cooperation is carried into effect where it has been brought to its highest development by means of a "cooperative fund," in which are set up the deposits made by the cooperating owners. Deposits to the credit of these cooperative funds aggregated $128,240.89 during the year.

In this financial cooperation it is planned that the cooperator's expenditures per acre shall not be less than those of the Forest

Service in the region. Large landowners pay their pro rata share of the actual cost of protection and suppression; for small owners the agreements provide for flat rates per acre, based upon average protection and suppression costs over a term of years. The drive that has been made for cooperation on the part of owners, as well as of municipalities, water users, and others owning no lands but having hardly less concrete interests at stake, has brought good response. The interest of residents and settlers is secured through personal contact by the rangers and other forest officers, supplemented by hammering home upon them by all available means of publicity the vital necessity of guarding against fire and operating quickly by concerted action when fires occur.

Frequently the Forest Service has had to expend funds from its appropriation for fire protection, although the burden should have been borne by others. It is obvious that in such a case there must be a definite placing of responsibility and that effort must be directed toward enlisting the active assistance of settlers, users of the forest resources, and others interested in the detection and suppression of forest fires. Responsibility for preventing and suppressing fires must be placed squarely upon all agencies which, because of their operations, create fires, and pressure, either by negotiation or by legal process, must be brought upon such agencies for the collection of fire costs and damages for which they are responsible. Cases of fire trespass, in which evidence justifying legal action can be adduced, are taken into court by the Department of Justice if a satisfactory settlement can not be reached in any other way. As the result of a vigorous policy in this direction a secondary line of cooperation is being built up, namely, an acceptance of Forest Service standards of fire prevention and suppression and the application of these standards by the outside agencies themselves as a measure of self-interest.

Important progress has been made in methods of fire control. The problems involved have been attacked at their roots. Successful fire control is not merely a matter of a quick, decisive fight against roaring flames. Such contests between man and the destructive forces of nature are merely incidents in a maze of matters which go to make up the whole of systematic fire control. Years of search have failed to disclose any simple or easy road to mastery of the problem of fire control in American forestry. Merely spending more money for guards and equipment, important as these are, is futile unless the most careful attention is given to a multitude of details involved in the management of the men, money, and equipment required for the work.

Control of summer fires begins the preceding fall, when a scattered forest personnel must analyze the results of the fire season then closing and by study and exchange of ideas learn the lessons the closing season has taught. During each winter detailed plans must be made covering the procurement, conditioning, and placing of tools and equipment for use during the coming season; plans for reaching the general public with talks and printed matter dealing with care with fire must be reviewed and revised; arrangements must be planned which will secure financial cooperation from private owners of land lying in or adjacent to the national forests and the personal effort of residents within or near the forest boundary

who may be needed when the fire danger comes the following summer; financial and organization plans must be made which will control the number of fireguards employed for each unit and determine just where each man is to be stationed. All the work covered by these plans which can possibly be done during the winter must be completed in order to lessen by that much the rush which begins with the opening of spring work.

During the spring months telephone lines and pasture fences must be repaired, tools and equipment placed at points throughout the forest which are likely to be most convenient when fires occur, guards hired in advance for the season's work, training camps for the guards arranged for and held, and final arrangements with cooperators worked out. Then comes the giving of final instructions to guards and their placement on lookout peaks and at guard stations. What happens after that, when careless users of the forest start fires or lightning sows destruction, is not so much a struggle between fire fighters and the flames as it is a test of the thoroughness and adequacy of the thinking and preparatory work which have gone on during the preceding months.

As has been indicated in previous reports, the wide variety of physical and human conditions encountered on the national forests, together with the scattered location of forest officers, positively precludes the formulation of uniform detailed plans and instructions by any central agency, no matter how expert it may be. Advance planning by the individual district ranger and forest supervisor is indispensable to successful fire control in each ranger district and national forest.

Viewing fire control in this light, a steady but extremely important development is occurring along two lines. First, there is gratifying activity on the part of the body of men concerned in the recognition of significant fire facts and in acting upon them. This promises well for early completion of the pioneer work. The most important need at present is to bring forest officers together regularly in training camps for group discussion of the knowledge and experience gained by each and for instruction by specialists in various branches of fire control. Secondly, a heightened sense of personal responsibility is to be found among forest officers. The most effective means of promoting it is by inspection by trained men which weighs the results obtained and fixes responsibility for both the good and bad work discovered.

Four years of experience with aerial forest-fire patrol has established that regular daily patrol by planes does not yield sufficient results to justify the cost. A given spot in the forest is under observation for only 15 to 30 minutes of each patrol. A fire which shows up just after the air patrol has passed must go unobserved and unreported, so far as aerial detection is concerned, until the next patrol, which may be the next day. The main dependence for the detection of fires must be placed on lookout men stationed on mountain peaks and towers. Nevertheless, planes have an important place in fire control. Planes and pilots should be placed a few hundred miles apart throughout California and the Northwestern States. When fires get large a reconnaissance from the air is a very useful method of securing vital information; smoldering fires started by lightning should be searched out by planes after bad electrical

storms; systematic air patrol may be very important for a few weeks at a time when a smoke blanket renders fire detection from stationary lookouts on mountain peaks ineffective. From selected points an average of from 25 to 50 flights yearly would be an important adjunct to the other available means of controlling fire on the national forests.

It is therefore highly desirable that some way be found, if possible, to resume the cooperation with the Air Service of the Army under which aerial patrol was formerly maintained in parts of the West. This, however, must probably await the time when the fiscal situation of the Government admits of special provision for meeting the expenses involved.

In the expenditure of the improvement appropriation in recent years pronounced preference has been given to protection facilities. By sacrificing other improvements less urgently needed, the telephone system so important to fire control has been brought up to a total of 28,896 miles, leaving only 8,599 miles of additional line needed to provide a reasonably adequate communication system for fire purposes. With the regular improvement appropriation this can be cared for fairly well, although the necessity for repair and reconstruction is creating a growing burden.

But little headway has been made, however, in the construction of fire-lookout houses. No form of administrative control will keep a man as continuously at his post as he should be if, while on his peak searching for smoke, he is exposed to the wind and chill of a high elevation or if his shelter on the peak is so small that he has to do his cooking and sleeping at a cabin some distance below. Years of experience have evolved a standard type of lookout house which enables lookouts to serve effectively as the eyes of the fire organization. One hundred and ninety-four such houses are now in use, but 224 are still needed for primary lookouts.

PROTECTION OF PUBLIC FORESTS FROM INSECTS.

The extent to which valuable timber may be killed by forest insects and the feasibility of preventing enormous losses through the application of proper control measures have both been thoroughly demonstrated in the large insect-control project in southern Oregon and northern California mentioned in last year's report. The work on this project is now about two-thirds completed. It has been conducted, under the leadership of the Bureau of Entomology, as a cooperative project between the various bureaus of the Federal Government having jurisdiction over Government owned or controlled lands in the region, the State of Oregon, and the owners of private lands. The work so far done has saved timber to a value of many times the expenditure for protection. Personal inspection of the work convinced me that it had been conducted efficiently and economically, with a fair distribution of the cost between the various owners of the property protected. The Government's share was financed out of a special appropriation, the unexpended balance of which should be reappropriated in order to finish the task.

Insects menace both publicly owned and privately owned timber throughout the country, and heavy losses of stumpage are not infrequent. The danger is especially acute in practically all of the

pine forests of the West within which many of the national forests are situated. In these pine forests an insect attack seldom destroys the possibility of further growth on the land as does fire, but the aggregate loss of commercially valuable timber is enormous, since the oldest and therefore the largest and more valuable trees are chiefly affected. The public forests urgently need an adequate and systematic organization for protection from insect losses along lines similar to those now followed in fire protection; and as in the case of fire protection, this organization must be able to cooperate effectively with the owners of intermingled or adjacent timberland within the threatened area.

The immediate requirements, particularly for the pine forests in the West, are adequate provision for research by the Bureau of Entomology looking to the development of the technique of control methods, and a fund which the Secretary of Agriculture may expend in protecting publicly owned or controlled timber, of whatever status, as emergencies require. At the present time serious losses from tree-destroying insects are occurring or are threatened particularly in certain of the pine forests in California, in Oregon, in northern and central Idaho, in central Montana, and in northern Arizona.

PROTECTION OF PUBLIC FORESTS FROM TREE DISEASES.

The need for adequate means of meeting dangers to our forests from tree diseases is brought home forcibly by the discovery, made by the Bureau of Plant Industry, that the white-pine blister rust is established in the forests of British Columbia and on its alternate host (the genus *Ribes*) in the State of Washington. This discovery marks the beginning of a serious economic problem. The presence of this imported disease is a danger not only to many millions of dollars' worth of merchantable western white-pine timber, both public and private, but also to the future crops of these trees, which are the most valuable of the important commercial trees in their respective regions. Other kinds of trees may keep the land productive, but these five-needled pines will bring the largest returns, and inability to grow them would be an economic disaster to the regions concerned and to the nation-wide users of lumber. It is good public economy and an elemental business precaution to prevent losses from this disease in the existing merchantable timber on the national forests and to protect the young stands from which the future crops of the same timber must come, just as losses from fire are guarded against.

The white-pine blister rust is an undesirable alien from Europe, where it prevents the growing of species of white pine over large areas. In its life cycle it alternates between the five-needled pines and currant or gooseberry bushes in the same way that wheat rust alternates between barberry and wheat plants. The Bureau of Plant Industry has demonstrated that in the case of this disease, as with others which have alternate plant hosts, protection is possible by the removal of one of the hosts, and in the case of this disease the eradication of all currant or gooseberry bushes within or near stands of

white pine is the necessary step. Wild currants and gooseberries are so widely distributed within and near the western forests, however, that while the progress of the disease may be delayed by quarantines and similar measures its ultimate spread throughout the white-pine-producing regions of the West seems certain, and the local control of the disease is necessary, just as the prevention of loss from forest fires is a matter of organization for the protection of specific areas.

The danger from this disease is recognized by many of the private owners of white-pine timber and by the agencies which administer publicly owned forests. A blister-rust advisory board, representing both public and private interests, has been formed in the West and has recommended prompt and vigorous action by the Nation, the States, and the private owners. There is urgent need for aggressive Federal leadership in meeting the menace of this disease in the western forests through the continuation of studies to develop practical means of combating the disease and by the active protection of the endangered Government property.

PROTECTION OF STATE AND PRIVATE FORESTS.

No new States established forest-fire protective systems during the year, but the effectiveness of the work markedly increased. Appropriations by the States for protection against forest fires, although still far from adequate, resulted in both an extension of the protected areas and a betterment of the lookout stations, trails, and similar improvements. Of all the States having important forest resources to protect, those in the Southeast, from South Carolina to Mississippi and Arkansas, inclusive, are the only ones yet remaining to take action against forest fires. This section is still a large center of lumber production and has in consequence not felt the pinch from dwindling timber supplies, and further, the southern forests are not susceptible to the kind of fires which destroy whole stands of timber and cause spectacular losses. However, there is none the less a need for protection, especially of the cut-over and young-growth lands, in order that new forests may come on and help supply future needs after the passing of the virgin stands. In the Pacific Northwest, where most of the merchantable timber is given systematic protection, the cut-over and regrowing lands are in some instances receiving relatively meager protection or none at all. There is just as urgent need for the protection of these cut-over and regrowing lands in the West as there is in the South.

The Federal appropriation for protecting from fire, in cooperation with States, the forested watersheds of navigable streams was the same as in the previous year—$400,000. The increase over the $125,000 received in 1921 induced some States to increase their protective budgets in order to receive larger Federal allotments during the past year. In consequence it was necessary to reduce the maximum allotment to any State from $25,000 to $24,000. The inadequacy of the present Federal cooperation grows more and more evident. As in previous years, special allotments from a contingent fund reserved for emergencies were made to the States which experienced severe fire conditions, compelling them to exceed their budgets of estimated expense. Such allotments amounted all told

to $11,300, and were made to Maine, Connecticut, New York, New Jersey, Maryland, Virginia, West Virginia, North Carolina, Louisiana, and Idaho.

The total allotments to the States, including emergency allotments, were as follows:

Cooperative expenditures in fire protection under the Weeks law, fiscal year 1923.

State.	Federal.	State.	Total.
Maine	$25,183.82	$136,181.56	$161,365.38
New Hampshire	6,705.52	31,178.85	37,884.37
Vermont	4,200.00	9,007.55	13,207.55
Massachusetts	8,399.82	80,522.42	88,922.24
Rhode Island	455.77	7,984.31	8,440.08
Connecticut	4,025.00	23,577.78	27,602.78
New York	24,368.26	162,706.28	187,074.54
New Jersey	5,775.00	54,742.86	60,517.86
Pennsylvania	24,000.00	488,783.50	512,783.50
Maryland	4,050.00	11,652.04	15,702.04
Virginia	17,663.40	17,663.41	35,326.81
West Virginia	10,500.00	20,036.82	30,536.82
North Carolina	12,306.88	14,272.96	26,579.84
Tennessee	9,981.01	9,981.01	19,962.02
Louisiana	21,750.00	43,668.49	65,418.49
Texas	14,000.00	14,047.43	28,047.43
Ohio	1,050.00	9,144.25	10,194.25
Michigan	22,285.92	138,502.03	160,787.95
Wisconsin	13,879.97	19,161.51	33,041.48
Minnesota	24,000.00	244,752.13	268,752.13
South Dakota	100.00	5,445.00	5,545.00
Montana	13,722.08	16,373.31	30,095.39
Idaho	29,037.58	93,584.71	122,622.29
Washington	24,000.00	78,626.93	102,626.93
Oregon	24,000.00	42,920.62	66,920.62
California	22,248.32	51,912.89	74,161.21
Administration and inspection	27,522.80	.....	27,522.80
Total	395,211.15	1,826,430.65	2,221,641.80

Unexpended balance, $4,788.85.
Appropriation, $400,000.

With protection against forest fires in the formative stage or entirely absent throughout a portion of the country, complete figures on the losses sustained are impossible to secure. Nevertheless, through the assistance of States where protective systems are established and of interested cooperators in other States, the Forest Service has been securing reports on forest-fire losses during the past seven years. These reports indicate an average for this period of 36,100 fires annually, with 7,244,000 acres of forest land burned over and immediate property losses of $16,463,000. The causes of fire were: Campers and smokers, 15.5 per cent; railroads, 14.6; incendiarism, 14.1; brush burning, 13.5; lightning, 8.7; lumbering, 5.7; miscellaneous, 6.6; and unknown, 21.3. The estimated number of fires in 1922 was 51,900, or 44 per cent more than the average, but they burned over only 13 per cent more forest land and the property loss showed practically no increase.

The indicated number of fires in 1922, with the damage caused and the forest land burned over, was as shown below. On account of the varying character and completeness of the data on the basis of which the totals are computed, however, regional comparisons involve elements of uncertainty.

Summary of forest fire statistics, by groups of States, for the United States (exclusive of Alaska), 1922.

Group of States.[1]	Number of fires.		Damage.		Forest land burned.	
	Total.	Per cent.	Total.	Per cent.	Total.	Per cent.
					Acres.	
United States (exclusive of Alaska)	51,891	100	$16,678,485	100	8,194,189	100
Northeastern group	8,054	15.5	1,865,659	11.2	298,315	3.6
Appalachian group	5,749	11.1	1,534,825	9.2	693,629	8.5
Southeastern group	15,935	30.7	5,727,469	34.3	4,515,061	55.1
East Mississippi group	1,467	2.8	467,890	2.8	210,724	2.6
West Mississippi group	9,337	18.0	1,956,707	11.7	1,377,502	16.8
Lake States group	2,019	3.9	1,199,459	7.2	333,228	4.1
Rocky Mountain group	3,601	6.9	844,925	5.1	152,061	1.8
Pacific group	5,729	11.1	3,081,551	18.5	613,669	7.5

[1] Northeastern group: New England States, New York, and New Jersey.
Appalachian group: Pennsylvania, Delaware, Maryland, Virginia, and West Virginia.
Southeastern group: North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi.
East Mississippi group: Ohio, Indiana, Illinois, Kentucky, and Tennessee.
West Mississippi group: Missouri, Arkansas, Oklahoma, Louisiana, and Texas.
Lake States group: Michigan, Wisconsin, and Minnesota.
Rocky Mountain group: Montana, Idaho, Wyoming, South Dakota, Colorado, Arizona, New Mexico, Nevada, and Utah.
Pacific group: Washington, Oregon, and California.

In addition to the direct loss which can be measured in dollars and cents, as given in the preceding table, there is an enormous loss of an indirect and intangible nature from the subsequent decay of fire-damaged timber, destruction of young tree growth, soil deterioration, erosion interfering with navigability of streams and the development of water power, damage from floods, destruction of wild life, impairment of recreational values, and similar consequences.

The total expenditure for protecting forest lands outside of Federal holdings is approximately $3,300,000 a year, of which States pay $1,900,000, private owners $1,000,000, and the Federal Government $400,000. The expenditures by private owners of forest land often materially exceed the amount indicated in years of special danger. About 40 per cent of the total expenditure is in the Northeast, 20 per cent in the Lake States, 30 per cent in the far West, and 10 per cent in the South. All told, the amount is a little more than one-third that necessary for adequate protection. Since it is expended on approximately one half of our State and private forest lands, in many instances they receive but partial protection, while the other half receives no organized protection whatever. Without the complete and adequate protection of privately owned forest lands there can be no hope for the production of a continuous yield of timber. Even where economic conditions make it practicable for private owners to grow timber crops, they are often hesitating because of the fire hazard and particularly the menace of fire from adjoining lands. Unless private owners can be assured of reasonably adequate protection they can scarcely be expected to keep their cut-over lands in a condition of productiveness. The private forest owner should be given a chance.

Like other big national undertakings, such as road improvement and agricultural extension, the protection of our forests can best be

given an impetus through the aid of the Federal Government. A general formula for the cost of protecting private forest lands which has been widely accepted is that the owners and the public should share it alike and that the share of the public, as represented by the Federal Government, should be approximately one-fourth. On this basis, if the yearly expenditure required to protect private forest lands in the United States is $9,263,000, as is estimated, the share of the Federal Government would be about $2,300,000 yearly, or nearly six times the present appropriation for this purpose.

NATIONAL FOREST MANAGEMENT.

TIMBER.

More timber was cut from the national forests during the past year than ever before in their history, and the receipts from sales were greater. The timber business of the year compared with that of 1922 is as follows:

Totals of timber sold, timber cut, and receipts from sales.

Fiscal year.	Timber sold (board feet).	Timber cut (board feet).	Receipts from sales of timber.
1923	2,288,585,000	991,982,000	[1] $2,641,244.08
1922	2,129,364,000	728,531,000	1,780,347.24
Increase	159,221,000	263,451,000	860,896.84

[1] The figures given on p. 10 include receipts for timber cut in trespass.

There has been on the whole a steady rise in the amount of timber cut and sold annually from the national forests since their creation. The sharp increase in the business last year is more than a temporary peak; it is the result of clearly defined economic forces that have been at work for several years and point to a continuing increase during the next decade.

Perhaps the greatest factor affecting the growth of the timber-sale business in the national forests is the continued activity in lumber production stimulated by the favorable market of the last two years. Throughout the United States and during practically the entire year urban and industrial construction has gone forward steadily.

The export lumber business has not fully recovered from the effects of the war, but well-informed men in the industry believe that the volume of lumber required for domestic use and the export trade combined will not recede from its present level.

Another prime factor affecting the volume of timber business in the national forests, as pointed out in last year's report, is the continued western migration of forest industries from the depleted regions of the East. Eastern sawmill capital is at present being invested more largely on the Pacific coast than elsewhere. This is reflected in the timber sales in the national forests of that region. In

California the increase in the timber-sales business of 1923 over 1922 was 145 per cent, and in Oregon and Washington it was 31 per cent. The increase in Alaska was 73 per cent, but this was largely to supply the needs of the Alaskan fisheries and other local industries.

As a usual thing national forest timber is more remote and less accessible than the privately owned timber, most of which was acquired before the creation of the forests. As a consequence, new capital is usually invested in private stumpage in preference to seeking that owned by the Government. The greatest call upon national forest resources will come when the bulk of the privately owned timber has been acquired by operating companies. The increase in the sales of stumpage on the national forests during the last year indicates that a considerable portion of the rampart of privately owned timberlands that stands between the national forests and the main-line transportation systems has been so acquired and that the sawmill capital yet to go West will tend more largely to seek national forest stumpage.

Among the outstanding timber sales of the year was the Bear Valley unit, on the Malheur Forest, in Oregon. It involves 890,000,000 board feet of timber, chiefly western yellow pine. This timber will bring into the Treasury not less than $2,250,000 in the 20 years of the sale. The management plan under which the sale was made contemplates a continuous supply of from 40,000,000 to 60,000,000 feet annually to one manufacturing center. The capital invested in this sale originated in the Lake States in the days of white pine and has moved south and west periodically since. So far as a supply of raw material is concerned, it will never have to move again.

Another sale of interest, not because of the large amount of timber or its bearing upon agricultural development in the surrounding region, but on account of the values involved, is that on the Burnt Cabin Creek unit, in the Coeur d'Alene Forest, Idaho. This sale covers approximately 3,360 acres on the Little North Fork of the Coeur d'Alene River, and involves the cutting of 70,000,000 feet of western white pine, white fir, Engelmann spruce, Douglas fir, larch, and hemlock, with white pine forming about 80 per cent of the stand. The successful bidder was awarded this timber at a price that will total $630,175. This averages a little better than $9 per thousand board feet, which marks a new level of values for western timber. The stumpage price of the white pine alone is $11.40 per thousand feet. A feature of the sale is that the purchasers agreed to acquire rights of way where the 10 miles of railroad within the forest crosses private land and to turn these over to the Government at the end of the operation. This will assure the Government an outlet by rail for the large amount of timber that remains on the Coeur d'Alene River.

Within two decades the bodies of merchantable timber in most of the national forests will be in demand by the lumber and paper industries. To utilize the present stands to best advantage, to cut them so as to assure a new crop of high quality, and to manage the whole development so that the principle of a sustained yield will not be endangered, necessitates technical skill and intensive forestry

practice, and the time when they will be needed is not 20 years away, but immediately. As shown by this year's jump in the volume of business, the demand for national forest timber is coming in a rush, and the service must be prepared to meet it with plans, methods, and trained men.

To take care of the growing volume of sales will require more and more preliminary timber surveys and management plans. Sales must be based on careful examinations covering large areas, so that mature and deteriorating timber may be cut at the earliest practicable time, the national properties developed in the most business-like way, and the cream of the timber, which is most desired by operators, not skimmed off without utilizing the less valuable species or less accessible portions of the stand. New operations can not be located where a perpetual supply of raw material will be assured without careful study of all economic and silvicultural factors, so as to keep the manufacturing capacity within the producing power of the soil. The application of sound technical methods to secure regrowth to the full timber-producing capacity of the soil will be necessary on a larger and larger area each year, and an increasing intensity of protection of the regenerating areas from fire, insects, and disease.

The current business is already taxing the service to the utmost. Less than 15 per cent of the 1,733 field men who are directly responsible for the cuttings on the national forests are trained foresters. Of the 143 supervisors who are in charge of the national forests only 60 are forest-school graduates, and of the deputy supervisors, only 8. To put into practice the sound technical methods that are essential to secure the results expected of the national-forest administration, there must be a material increase in the number of trained foresters.

To build up a sufficient corps of qualified and experienced sales officers, systematic training while in the service is also essential. In the past the volume of the sales work has not been so large and the demand of other lines of work has not been so great but that men could obtain the requisite training in the course of their employment. This condition no longer holds. To keep pace with current timber sales, the whole organization has been speeding up, and now there is neither time nor opportunity to train new men in the old way. Stations or camps for the training of timber-sales officers are entirely practicable, since the service has competent and experienced men available to impart the training required. This work should be gone at systematically through group training at instruction camps.

Timber cut under sales, calendar year ended December 31, 1922.

State.	Board feet.			Value.		
	Commercial sales.	Cost sales.	Total.	Commercial sales.	Cost sales.	Total.
Alabama	12,000	.....	12,000	$113	.....	$113
Alaska	23,943,000	.....	23,943,000	41,400	.....	41,400
Arizona	55,243,000	616,000	55,859,000	127,174	$525	127,699
Arkansas	6,735,000	195,000	6,930,000	31,987	201	32,188
California	214,494,000	2,111,000	216,605,000	661,870	1,265	663,135
Colorado	28,843,000	1,499,000	30,342,000	70,437	1,365	71,802
Florida	1,208,000	.....	1,208,000	4,860	.....	4,860
Idaho	90,294,000	4,197,000	94,491,000	314,343	3,983	318,326
Michigan	60,000	.....	60,000	174	.....	174
Minnesota	2,535,000	.....	2,535,000	12,461	.....	12,461
Montana	42,741,000	4,954,000	47,695,000	100,592	4,290	104,882
Nevada	1,685,000	259,000	1,944,000	1,912	225	2,137
New Hampshire	2,962,000	.....	2,962,000	18,001	.....	18,001
New Mexico	23,218,000	1,127,000	24,345,000	38,543	1,040	39,583
North Carolina	8,295,000	.....	8,295,000	23,308	.....	23,308
Oregon	168,209,000	2,844,000	171,053,000	394,890	1,711	396,601
South Dakota	18,343,000	838,000	19,181,000	54,118	767	54,885
Tennessee	6,235,000	86,000	6,321,000	14,268	86	14,354
Utah	7,604,000	900,000	8,504,000	17,125	908	18,033
Virginia	3,823,000	12,000	3,835,000	10,296	11	10,307
Washington	104,694,000	516,000	105,210,000	180,654	309	180,963
West Virginia	22,000	.....	22,000	77	.....	77
Wyoming	44,949,000	672,000	45,621,000	99,560	647	100,207
Total, 1922	856,147,000	20,826,000	876,973,000	2,218,163	17,333	[1] 2,235,496
Total, 1921	666,191,000	21,731,000	687,922,000	1,646,817	16,363	[2] 1,663,180

[1] In addition, minor products not convertible into board feet were cut, value, $8,096.
[2] In addition, minor products not convertible into board feet were cut, value, $4,511.

Timber sold, calendar year ended December 31, 1922.

State.	Board feet.			Value.		
	Commercial sales.	Cost sales.	Total.	Commercial sales.	Cost sales.	Total.
Alabama	110,000	.....	110,000	$196	.....	$196
Alaska	22,533,000	.....	22,533,000	36,401	.....	36,401
Arizona	23,248,000	504,000	23,752,000	53,851	$490	54,341
Arkansas	5,838,000	198,000	6,036,000	27,216	194	27,410
California	1,107,636,000	2,045,000	1,109,681,000	3,638,027	1,363	3,639,390
Colorado	29,094,000	1,082,000	30,176,000	75,971	1,101	77,072
Florida	846,000	.....	846,000	3,055	.....	3,055
Idaho	65,270,000	5,010,000	70,280,000	246,907	4,789	251,696
Michigan	60,000	.....	60,000	174	.....	174
Minnesota	288,000	.....	288,000	1,909	.....	1,909
Montana	36,231,000	4,182,000	40,413,000	93,677	4,036	97,713
Nevada	1,594,000	150,000	1,744,000	1,814	141	1,955
New Hampshire	1,349,000	.....	1,349,000	4,976	.....	4,976
New Mexico	12,840,000	1,234,000	14,074,000	35,695	1,121	36,816
North Carolina	6,256,000	.....	6,256,000	10,775	.....	10,775
Oregon	57,196,000	3,298,000	60,494,000	102,838	2,030	104,868
South Dakota	26,913,000	732,000	27,645,000	93,084	725	93,809
Tennessee	4,255,000	84,000	4,339,000	9,163	84	9,247
Utah	11,689,000	1,173,000	12,862,000	25,942	1,193	27,135
Virginia	6,500,000	22,000	6,522,000	17,143	22	17,165
Washington	366,318,000	761,000	367,079,000	624,453	470	624,923
West Virginia	131,000	.....	131,000	300	.....	300
Wyoming	70,874,000	920,000	71,794,000	203,206	950	204,156
Total, 1922	1,857,069,000	21,395,000	1,878,464,000	5,306,773	18,709	[1] 5,325,482
Total, 1921	1,253,579,000	23,412,000	1,276,991,000	3,743,463	19,330	[2] 3,762,793

[1] In addition, other products not convertible into board feet were sold, value $21,989.
[2] In addition, other products not convertible into board feet were sold, value $5,485.

Number of timber sales, classified according to amount of sale, calendar year ended December 31, 1922.

State.	$100 or under.			$101 to $500.	$501 to $1,000.	$1,001 to $5,000.	Over $5,000	Total.
	Commercial.	Cost.	Total.					
Alabama	11		11					11
Alaska	181		181	3	1	8	2	195
Arizona	780	269	1,049	9	5		3	1,066
Arkansas	40	75	115	2	2	2	2	123
California	509	359	868	20	4	17	11	920
Colorado	527	253	780	9	3	5	5	802
Florida	61		61					61
Idaho	942	1,477	2,419	14	7	13	13	2,466
Michigan	6		6					6
Minnesota	5		5			1		6
Montana	660	1,049	1,709	17	4	9	3	1,742
Nebraska	13		13					13
Nevada	112	53	165					165
New Hampshire	118		118		1	2		121
New Mexico	567	509	1,076	1	4	5	1	1,087
North Carolina	200		200	3	2	2		207
Oklahoma	25		25					25
Oregon	318	581	899	6	4	4	8	921
South Dakota	319	134	453	7	3	9	5	477
Tennessee	147	39	186	1	1	3		191
Utah	333	619	952	8	1	1	1	963
Virginia	336	11	347	1	6	2		356
Washington	427	122	549	8	7	10	6	580
West Virginia	8		8					8
Wyoming	228	176	404	3	1	2	4	414
Total, 1922	6,873	5,726	12,599	112	56	95	64	12,926
Total, 1921	6,820	6,621	13,441	93	48	82	26	13,690

REFORESTATION.

The following tabulation shows the national forest area planted or sowed to commercial timber during the calendar year 1922, by States:

Planting and sowing on national forests, by States, calendar year ended December 31, 1922.

State.	Area planted.	Area sown.	Total.
	Acres.	*Acres.*	*Acres.*
Minnesota	1,772.13		1,772.13
Idaho	1,301.30	20.00	1,321.30
Washington	1,309.00		1,309.00
Nebraska	947.60		947.60
Colorado	792.33		792.33
Michigan	607.00		607.00
Montana	286.00		286.00
West Virginia	21.00		21.00
Oregon	15.00		15.00
Florida		1.50	1.50
South Dakota	.53		.53
Total	7,051.89	21.50	7,073.39

At the present rate of progress in planting it will take from 150 to 200 years to reforest the denuded areas in the national forests that can be restored to productivity in no other way. That our present

program of planting is grossly inadequate is evident, and the growing realization of the future shortage of timber supplies emphasizes the need for a more comprehensive planting program. As a first step in this direction the Forest Service is this year making a survey of the national forests with a view to submitting a plan for the reforestation of denuded areas within a reasonable period of time. Its execution, however, must await provision by Congress of increased funds.

RANGE.

GENERAL CONDITIONS.

Broadly speaking, the grazing season of 1922 was about normal. On more than 40 per cent of the national forests the rainfall was below average, but it came at a time to do the most good, and the feed, although not particularly heavy, produced fat cattle and sheep. The winter of 1922–23 was comparatively mild, with hay plentiful, and the spring of 1923 opened up sufficiently early to have green feed available at the usual time. The winter losses were therefore light, although as a rule both cattle and sheep were rather thin at the time of entering the national-forest ranges.

In the Southwest, however, especially in New Mexico and Arizona, the drought which has now lasted for practically three years was broken only in part, the precipitation being extremely spotted and the growth of vegetation light. This was especially true in southern New Mexico and Arizona, and sheepmen whose stock lambed early in 1923 suffered heavy losses, due to lack of green feed for the young stock. While beef cattle on nearly all ranges were in excellent condition in the fall of 1922, the average weights were at least 100 pounds below normal. To a large extent lambs placed on the market were also underweight.

Losses from all causes during the year were somewhat less than average. The work of the Biological Survey in eliminating predatory animals has undoubtedly caused a decrease in losses from that source, and the absence of heavy rainfall prevented a rank growth of poisonous plants, especially larkspur, which cut down the losses from this cause materially.

USE OF THE RANGE.

The table below shows the number of stock grazed under permit and the number of permits issued for the calendar year 1922. The business was somewhat less than in previous years, primarily because of stock sales to reduce indebtedness, plus the inability of many stockmen to meet the grazing charges, which forced them to hold their stock on their own lands. However, the vacant ranges will not lie idle long, as other stockmen will apply for the next season.

Grazing permits issued and number of stock grazed, calendar year ended December 31, 1922.

State.	Permits issued.	Number of stock.			Permits issued.	Number of stock.	
		Cattle.	Horses.	Swine.		Sheep.	Goats.
Alabama	9	203					
Arizona	1,349	295,927	3,154	307	104	298,114	1,670
Arkansas	183	2,614	25	164	5	14	179
California	2,688	200,753	5,840	440	453	500,507	8,479
Colorado	4,288	356,292	7,438	220	683	903,328	1,136
Florida	42	3,407		143	6	1,961	60
Idaho	3,729	161,423	10,059		863	1,557,223	
Montana	2,650	157,438	11,787		403	626,364	62
Nebraska	40	9,456	608				
Nevada	506	70,939	3,043		118	325,364	
New Hampshire	19	195	12				
New Mexico	1,809	146,047	3,147	291	469	323,868	27,420
North Carolina	289	1,436	59	118	34	309	
Oklahoma	56	3,292	258				
Oregon	2,120	143,514	7,787	20	476	684,274	883
South Dakota	765	32,713	2,931		3	4,025	
Tennessee	105	890	8	7	8	148	
Utah	7,310	164,278	7,311	175	1,728	783,471	
Virginia	229	2,126	21		5	93	
Washington	799	24,554	1,771		135	172,481	
West Virginia	7	58			1	16	
Wyoming	1,155	137,558	4,381		317	670,130	
Total, 1922	30,147	1,915,113	69,640	1,888	5,811	6,851,690	39,889
Total, 1921	31,027	1,999,680	78,115	2,453	6,214	6,936,377	43,574

ECONOMIC CONDITION OF LIVESTOCK INDUSTRY.

During the last year the sheep industry has staged a wonderful comeback. The rapid recovery in the price of wool, together with the strong demand for lambs for fattening purposes, made more general by the undoubted shortage in this class of stock, gave the flock masters excellent returns. With the improved conditions the demand for sheep by men who desired to get into the business forced up prices. A break in the price of wool in June, 1923, brought a comparatively small loss to the wool producers themselves, the majority having sold their wool early in the spring. The cattle industry, however, has shown little or no recuperation. The demand for young steers from the southwestern ranges in the spring of 1923 was disappointingly low, and many cattlemen were unable to liquidate their indebtedness. If a strong demand for young stock and feeders does not materialize this coming fall, many of the range cattlemen of the West will undoubtedly find themselves in a very precarious position.

In order to assist all classes of stockmen using the national forests, the policy was continued of dividing the payment of grazing fees above a minimum of $10 into two installments, the first to be paid at the time the stock entered the forest and the second in the fall. Every possible leniency has been shown the stockmen who were unable to meet their grazing payments for the season of 1921. It will be remembered that early in that year Congress, upon recommendation of the Secretary of Agriculture, authorized a postponement to September 1 of the payment of all grazing fees for the calendar year 1921. Conditions not having improved, Congress later postponed the date until December 1 in order that the stockmen

might secure funds from the sale of surplus cattle at the end of the grazing season.

The following table shows the number of delinquents and the total amount of unpaid fees on July 1, 1923, for the grazing seasons of 1921 and 1922:

Delinquent grazing fees, fiscal years 1921 and 1922.

District.	Number of permittees.	Amount.	District.	Number of permittees.	Amount.
1	66	$2,691.53	6	148	$5,307.24
2	248	12,888.08	7	26	480.94
3	409	56,281.11			
4	146	3,649.70	Total	1,056	81,890.91
5	13	592.31			

It is gratifying to observe that the total delinquency for these two years of privation and hardship among the cattlemen is less than 2 per cent of the grazing receipts for these years. Probably a portion of this will have to be dropped from further consideration as uncollectible, the majority of the delinquent owners having been forced to dispose of their livestock and go out of the business. Considering the wide distress among livestock owners during these years, this showing is better than was to be expected.

PENDING CHANGES IN GRAZING REGULATIONS AND PROCEDURE.

The regulations and instructions now governing the use of national forest ranges were made the subject of careful study with a view to their thorough revision. In this study an earnest effort was made not only to improve the regulations from the standpoint of administrative methods and practice, but also to introduce such modifications as would best serve the interests both of the stockmen and of the public, by promoting more stable use of the ranges and by helping to rehabilitate the industry after the period of depression through which it has passed. The leading changes proposed are—

(1) Grazing fees amounting to $10 or more may be paid regularly hereafter in two installments.

(2) Term permits issued in 1925 will run to the close of the 10-year period, expiring in 1934. On these term permits, however, reductions in the number of stock grazed may be made at the end of any year if necessary to prevent damage to the range, forest growth, or watershed, and at the expiration of the first five years of the period a reduction may be made to admit to the range new applicants properly qualified or to allow increases to small permittees. The amount of this reduction, taken together with all reductions made for protection during the 5-year period, will not exceed 10 per cent.

(3) What will be known as an "exemption limit" will be established, between the present protective and maximum limits, below which permittees engaged permanently in livestock production will not be called upon to make reductions in favor of new applicants not wholly engaged in stock grazing as their means of livelihood.

(4) No limitations will be placed upon the frequency of sales of livestock accompanied by waivers of grazing preferences. The pur-

pose of this change is to allow permittees more opportunity to sell at favorable terms and to facilitate the purchase of livestock grazed under permit by persons wishing to engage in the business.

These and many other changes were first drafted by a committee of forest officers expert in grazing matters, working with a committee of practical stockmen representative of the entire range country. Later on, after review by me, they were again submitted to the committee of stockmen for further discussion and such recommendations as in their judgment seemed advisable. It is believed that the new regulations will be satisfactory to the permittees and will prove of decided value to the livestock interests, while safeguarding all the interests of the Government and the public and promoting the conservation and fullest use of the forage resource.

RANGE APPRAISAL.

The range-appraisal work, which has been conducted for nearly two years, is practically closed, and the review of the reports, harmonizing of various recommendations, and final adjustment of the grazing fees in accordance with the figures shown by the appraisal are now in progress. No figures are yet available upon which to forecast what the new grazing fees will be. Before final action is taken on the proposed charges they will be placed before representatives of the various livestock associations for a full, friendly discussion, and such changes will be made as seem justified by the facts presented. When the figures are correlated and properly tabulated the Forest Service will for the first time have comprehensive and dependable data on (1) the commercial value of comparable private lands used in reasonably large bodies for the grazing of livestock under conditions similar to those found on the national forests; (2) the value of the individual grazing allotments or districts in the national forests, considering their accessibility and their forage and water resources; (3) the estimates presented by stockmen as to the cost of compliance with the national forest grazing regulations, which many permittees honestly believe are frequently a burden to the industry; and (4) the actual grazing needs of the stockmen and farmers in the immediate vicinity of each national forest.

The new grazing fees will be fair and reasonable valuations of the respective ranges, based upon the commercial value of comparable private lands, but with full consideration of the cost of complying with the grazing regulations on national forests and of the public and community benefits sought under public range administration. These include the correlation of range use with local ranch lands and water developments and the promotion of agricultural settlement. The new fees will go into effect with the grazing season of 1925.

COOPERATION WITH PERMITTEES.

Cooperation with permittees has been an underlying principle in national forest range management almost from the beginning. The range users, through selected advisory boards, are given a wide share of responsibility in the administration of grazing. This includes such matters as the opening up of stock trails, the improvement of

springs, the erection of drift fences to keep the stock on their proper ranges, the eradication of poisonous plants, and range adjustments between classes of stock.

Another form of cooperation is the enforcement of special rules adopted by a majority of the users of a particular range and approved by the Forest Service as fair and beneficial. These rules deal with such matters as the placing of salt on the ranges, the handling of round-ups, and the exclusive use of purebred bulls.

Special rules are now in force on the national forests through cooperation of this character with 733 local livestock associations. Each represents a majority of the permittees using a particular range. Out of the many thousand permittees affected by these special rules, the number who have opposed the collection of assessments by the associations or attempted to evade the requirements is extremely small. The livestock associations, furthermore, have been of enormous assistance to the Forest Service by affording responsible local agencies with whom many phases of administration, such as the proper seasons for grazing each type of range, rotation grazing, and other improvements in range use, can be discussed and often directly settled.

In revising the grazing regulations it is proposed to extend the cooperation with stockmen still further through the issuance, in some instances, of a single grazing permit to an association for the total number of stock which its members are entitled to graze on the forest. A broader responsibility will thereby be placed upon the association for the enforcement of satisfactory management of stock on the range. Where the associations represent communities in which the stock interests are closely related it is felt that this new plan will be acceptable to the stockmen, as it gives them a larger responsibility in local range management than they have heretofore had.

One of the outstanding examples of cooperation was the revision of the grazing manual by forest officers in conference with a committee representing the various livestock associations in the western range States. This committee discussed the proposed changes, suggested modifications, and in many ways aided materially in harmonizing points of view and improving the regulations. In the redetermination of grazing fees the cooperation of the livestock associations was sought and will be an essential factor in arriving at the final result.

STABILITY OF GRAZING PRIVILEGES.

There has been a feeling among range livestock men that the grazing privileges on the national forests were not stable. The permits have been revocable at the discretion of the Secretary of Agriculture, and the policy of the service has been to encourage new settlers by granting them limited grazing privileges on fully occupied ranges through moderate reductions in the numbers of stock run by the larger and older permittees.

The range appraisal has demonstrated that national-forest permittees have, in fact, been exceptionally secure in their tenure of range use in comparison with what has happened on other large bodies of lands leased for grazing, whether State, Indian, or private.

Thousands of our permittees have been using the forest range year after year from the first season when permits were issued and are grazing practically on the same ranges and about the same number of stock as originally. Some owners who once held permits for large numbers of stock are now grazing smaller herds, but in a majority of these cases the reduction is due to business changes rather than the effect of national-forest regulations. Where the contrary was the case, the reduction was made for the benefit of the community, with a view to a fairer distribution of the grazing privileges.

In the early days of the service, when there were yet many vacant homesteads on the public domain, the policy of aiding and encouraging new settlers by grazing permits on a near-by forest was fully justified, even where it involved reductions in the herds of the larger permittees. That condition, however, has changed so largely that such reductions are now seldom necessary. The available agricultural lands near or adjacent to the national forests are practically gone, except here and there where they can be reclaimed through irrigation projects. With this true, it is believed that the issuance of 10-year permits and the creation of the exemption limit will make the tenure and stability of grazing privileges as satisfactory as possible, considering that the Federal Government must retain in its hands the control of its property both to insure its sustained productivity and to accomplish the maximum public benefits from its use.

THE UNRESERVED PUBLIC RANGES.

No small part of the instability in the western livestock industry has resulted from the unregulated use of some 175,000,000 acres of open and unreserved public-range lands. Since the earliest days of livestock production in the West these areas have been open-grazing commons, utilized without let or hindrance on the principle of "first come, first served." Except where particular stock outfits have been able to control public land through the ownership of watering places or other facilities, competitive and unrestrained use has usually brought about a striking deterioration in the productivity of these areas. They no longer contribute to the production of livestock products what they originally afforded or what they might afford if properly grazed.

A large number of western stockmen are dependent upon these ranges for a part of the season's pasturage, but with no system of allotment or control the availability of the public lands in connection with established ranches has become more and more of a gambler's chance. In many cases open ranges are required for spring and fall grazing by livestock whose winter feed is assured on ranches and whose summer pasturage is assured on national-forest allotments. In the cases of those flock masters the deterioration of the open ranges and the uncertainty attending their use has become an element of business instability of far-reaching proportions.

There is a clear need for a form of public-range administration which will in some degree restore their original forage-producing value and afford security of use by the livestock producers most equitably entitled to them, a scheme of administration more or less comparable to that now applied on the national forests. No one appreciates this situation more clearly than the western stockmen

themselves, who are prepared to assist, through local cooperative associations, in working out a reasonable plan of public-range regulation. The principle of local option might well be followed in undertaking a plan of this character, basing the need for its application in particular localities upon the judgment of the range users themselves. The economic difficulties which the livestock industry of the Western States is now seeking to overcome have emphasized more clearly than before the weakness of the industry at this point. And in its efforts to aid the livestock industry in attaining a more stable and profitable footing it is doubtful if there is any one thing on the part of the Federal Government which would accomplish more in the long run than to provide some flexible plan for regulating the use of the open public ranges in cooperation with the stock growers directly concerned.

RANGE IMPROVEMENT FUNDS NEEDED.

Additional funds are needed for the equipment of national forest ranges with boundary and division fences, the development of water, and the eradication of poisonous plants. Because of the urgent need of improvements for fire control it has been possible hitherto to devote only a relatively small sum to range improvements. Such improvements as have been erected have been largely paid for by grazing permittees, but it is doubtful if much further assistance can be obtained from them, at least without substantial cooperation from the Government. Furthermore, to facilitate the best management of the ranges, it is urgent that the Government itself own at least a major interest in the improvements built on Government land. Many national forest ranges can not be adequately protected or conserved without the construction of boundary or division fences. Other ranges can not be utilized without developing water or eradicating poisonous plants. An ultimate expenditure of from two to three million dollars will be needed to obtain full use and economic returns from the national forest ranges without subjecting them to deterioration. The urgent projects which have been surveyed and which should be pushed immediately will cost approximately $170,000.

RECREATION AND GAME.

The national forests, because of their public character, great scenic attractiveness, widespread distribution, and proximity to the centers of population of the States in which they are situated, have always been the natural recreational fields for large numbers of people. In earlier years, however, their relative inaccessibility, due to the lack of roads and trails, kept the number of visitors down, and consequently recreation offered few problems of management or protection. The results of the successive Federal road acts and the phenomenal growth in the use of motor vehicles have now made recreation in the national forests a major activity which, though relatively unproductive of money returns, is of outstanding public importance. The number of people resorting to the national forests for health and pleasure has borne almost a constant relation to the increasing mileage of constructed road and the number of personally owned motor cars.

The first comprehensive attempt to estimate the numbers of people using the national forests for recreation was made in 1916, when an estimated total of 2,370,000 persons was reported. Recent verifications of succeeding estimates yield the following figures:

Year.	Visitors.	Year.	Visitors.
1917	3,160,300	1920	4,832,671
1918	3,322,565	1921	5,433,420
1919	3,964,344	1922	6,172,942

Thus in six years the estimated number of visitors virtually doubled, and all indications point to a continued increase for years to come.

The use of the national forests for recreation is in all respects deserving of encouragement. It means for no small part of our population a valuable opportunity and privilege. Properly provided for, recreational use will add valuable elements to our national life without seriously impairing the capacity of the forests to create wealth or render other public services. But it has become clear that if the annual occupancy of the national forests by increasing millions of people is not properly provided for serious consequences to public health and property will develop. Those frequenting the forests naturally concentrate at the points offering the most attractive camping facilities or the best natural opportunities for outdoor play. In doing so they may create bad sanitary conditions, which menace not only their own health and that of residents within the forests, but also the well-being of remote residents on the lower reaches of the streams and of municipalities dependent on such streams for their water supply. They may also create a fire hazard which adds materially to the difficulty of protecting the public properties.

The solution of this problem does not lie in the restriction of recreational use, but in making adequate provision for it by the installation of simple facilities essential to public health, comfort, and security, such as toilets, water supplies, garbage pits or incinerators, fireplaces, etc. In 1922 a study was made of 960 specific camp grounds used by 1,355,000 people annually. For the proper development and protection of these camps facilities are required to a total estimated cost of $122,259, which would amount approximately to 2 cents for each person using the camp grounds in a single year. Most of the facilities needed bear directly on the problems of public health and protection of public property. To date the total sum appropriated to meet these requirements has been only $25,000. This has been wholly inadequate to meet the needs of 6,000,000 people. An expenditure roughly amounting to 5 cents for each person using the forests annually for recreation purposes would permit the installation of practically all of the most necessary facilities. Considering the numbers of persons who would be benefited by such an expenditure, the probable improvement to the public health, and the reduction in fire losses, it would be a distinct economy to make this expenditure as rapidly as the financial situation of the Government will permit.

Forested areas are the natural abiding place of game animals of every kind, while the streams that find their sources therein furnish

ideal breeding grounds for fish. One of the important duties of forest officers in the field is the protection of these resources, which are related to the use of the forests as recreation grounds.

The question is constantly asked, Are game animals increasing or decreasing? The annual game reports submitted by each forest supervisor show that, contrary to the general opinion, the larger animals, especially deer, while increasing only in certain regions, are probably about holding their own. On the game preserve in the Kaibab National Forest in Arizona, with 20,000 deer, on the Trinity National Forest in California, with 26,000, and on the California National Forest in the same State, with 40,000, the numbers are increasing to a point where the disposition of the surplus is already a problem. This question as it relates to the Kaibab herd is now under consideration in cooperation with the State and the Biological Survey.

The valuable species of fish, however, are undoubtedly being depleted faster than the streams are restocked. It is generally admitted that the chief cause for fished-out streams, as well as depleted hunting grounds, is the automobile. The extension of excellent roads into regions hitherto almost inaccessible save on horseback or on foot brings people into the forests by thousands from increasing distances. Streams that a few years ago furnished excellent sport for a few adventurous fishermen who made their way over rough trails and down deep canyons are now brought within easy reach by road.

The automobile and good roads are, of course, here to stay. The situation must be met not only through wider and more frequent restocking of the streams, radical regulation of the number of fish that can be taken by each person each day, cutting down bag limits and open seasons, and strict game-law enforcement, but also by the development of scientific game administration based on thorough knowledge of the requirements, habits, breeding capacity, and life history of the various species, to the end that conditions favorable to their production up to the limit of what is desirable, all things considered, may be maintained or provided. The wild-life resources of the national forests must be administered, fostered, and utilized much as are the timber and forage resources. The cost of this activity, in common with providing facilities for recreation and conserving the sources of water, will never be recovered in the form of commercial receipts, but is justified by the valuable public service which the national forests can thus contribute.

Game refuges and fish-breeding streams or ponds should be set aside to provide for protected breeding, careful consideration must be given to available food supplies, and a system of regulated use devised that will prevent depletion. The Forest Service is working on some of these problems in cooperation with the Biological Survey and the Bureau of Fisheries. It is also collaborating to the fullest extent possible with the game departments of the respective States in the enforcement of State laws, the selection and special protection of State preserves, and the study of local situations and needs with a view to bettering fish and game administration.

The last two or three seasons, both summer and winter, have been favorable to the elk in the Yellowstone region. Calf crops have

been unusually large and the herds are increasing. This has occurred in the past, and if the history of the elk is repeated there will be a gradual increase in numbers until an unusually hard winter such as occurred in 1910–11 or in 1919–20 takes a heavy toll. This apparently is nature's method of taking care of the surplus.

There is abundant summer range for even larger elk herds, but winter feed is limited. The Government lands lying immediately north of the Yellowstone Park, along the Yellowstone River, have been withdrawn by presidential proclamation pending action by Congress. They could be added either to the Yellowstone National Park or to the adjacent Absaroka National Forest. Unfortunately, local public sentiment is opposed to such action, and the preservation of this comparatively small piece of winter range appears no nearer solution than it was 10 years ago, when first taken up. The area contains 56,000 acres, of which 12,000 acres are unreserved and unappropriated public domain, 18,000 acres are the property of the Northern Pacific Railroad, 2,000 acres are Montana school lands, and 24,000 acres are private grazing and agricultural lands. Only 2,600 acres of the latter are actually used for farming purposes, the rest being pure grazing lands. The Forest Service has already withdrawn about 65,000 acres of the same kind of land adjoining this tract to the east, within the Absaroka National Forest, for the use of the elk in winter.

That part of the area belonging to the Northern Pacific Railroad is being withheld from sale or lease pending some action by Congress, with the probability of an exchange if the rest of the area is set aside for winter elk range. The land which is in the hands of the settlers can not, of course, be secured except through purchase. A great step forward will be made, however, if through congressional action the lands belonging to the Government are added to the national forest or national park.

As on a number of other protected Federal areas, the buffalo, deer, and elk in the Wichita game preserve in Oklahoma have increased to a point where it will become necessary to dispose of a number of them each year so that the herds can be kept within the grazing capacity of the land available. The matter is now being carefully considered with a view to working out a plan of disposal which will best meet all public requirements.

Special problems are constantly arising in connection with the recreational and wild-life resources of the national forests. The American people are advancing rapidly in appreciation of the great social value of forest spaces and their wild life. A plea is now made for the reservation of certain national forests, or parts of them, from the commercial use of timber and forage, or even from customary forms of recreation, like public camp grounds, summer homes, and hotels—indeed, from the very building of roads which would make these areas accessible to considerable numbers of visitors. What these people want is not parks but stretches of untrammeled wilderness, deliberately reserved as such, which only a few of the more hardy and "elect" among the seekers of the out of doors can penetrate, relying upon their unaided skill in woodcraft. This plea has been made particularly with reference to the Kaibab National Forest in Arizona and the Superior National Forest in Minnesota, or parts of them. It expresses an admirable conception of the value of the

forest frontier to the physical and social health of the American people. It is a wholesome reaction from the multiplication of improved roads and automobiles.

The national forests contain many areas of rugged mountains, which do and always will perform this distinctive service to the American out of doors. The deliberate withholding from commercial use, road building, or other forms of local development which would naturally take place can not be decided offhand without consideration of all the interests that may be involved and the sacrifices that may be entailed. Secretary James Wilson's instructions that the national forests be administered "for the greatest good of the greatest number in the long run" are as sound in 1923 as in 1905. But the greatest good of the greatest number of American people in the long run undoubtedly does call for abundant opportunities for a rugged and unspoiled taking to the woods. This question can only be answered by a broadgauge weighing of all the forms of service, social as well as economic, which a national forest can render, and then planning its development and administration in harmony with its greatest possible service to the public.

WATER POWER.

The following tabulation contains data concerning water-power permits or easements granted by the Department of Agriculture under former legislation and in effect on June 30, 1923:

Water-power development and transmission-line easements under permit or easement, fiscal year 1923.

Class of permits or easements	Transmission lines only.			Power projects (reservoirs, conduits, and power houses).		Total number permits or easements.
	Number permits or easements.	Length in miles.		Number permits or easements.	Estimated average output (in horsepower) at minimum discharge.	
		Within national forest boundaries.	On national forest land.			
Permits or easements in force at close of fiscal year:						
Rental—						
Preliminary	.....	.....	.....	3	900.0	3
Final	151	1,133.03	836.41	81	594,086.0	232
Free permits or easements	21	154.02	120.96	93	24,610.4	114
Total	172	1,287.05	957.37	177	619,596.4	349
Construction completed at close of fiscal year:						
Rental permits or easements	151	1,133.03	836.41	71	374,501.0	222
Free permits or easements	21	154.02	120.96	82	7,315.4	103
Total	172	1,287.05	957.37	153	381,816.4	325
Construction incomplete at close of fiscal year:						
Rental permits or easements	.....	.....	.....	9	217,745.0	9
Free permits or easements	.....	.....	.....	10	17,280.0	10
Total	.....	.....	.....	19	235,025.0	19
Construction not started at close of fiscal year:						
Rental permits or easements	.....	.....	.....	4	2,740.0	4
Free permits or easements	.....	.....	.....	1	15.0	1
Total	.....	.....	.....	5	2,755.0	5

During the year 57 applications for projects in whole or in part on national forest land were received by the Federal Power Commission. This exceeds by 12 the number for the preceding year, and is over half the total received during the year for permits on all Government lands and navigable streams.

The Federal Power Commission referred 33 applications to the Forest Service for engineering report and 20 for administrative report. At the end of the year the Forest Service was supervising and inspecting the operations of 78 permittees or licensees under the Federal water power act. On 16 of these cases, all of which are in Alaska, it is supervising the stream-gauging operations also.

The utilization of the pulpwood resources in the Tongass Forest in Alaska depends very largely upon the development of water power. As a result of field investigations, especially those made by the Forest Service during the past three years, a considerable number of promising sites have been discovered. Several applications for permit or license have been filed with the Federal Power Commission, the expressed purpose being the utilization of power in the manufacture of wood pulp. By law competition is essential to the sale of national forest timber. To carry out this requirement and comply with the provisions of the Federal water power act, the Forest Service and Federal Power Commission have entered into an agreement under which action upon applications for water power and timber will proceed simultaneously as far as possible. After the completion of advertising and the submission of bids for the timber the Forest Service and the Power Commission will determine to which applicant, ordinarily the highest bidder, both timber and power permit shall be awarded. Both timber award and power permit are subject to cancellation if the right to either privilege is lost. The same period will be allowed for the completion of surveys and plans for timber and power development, and the water-power license and the final timber contract will be acted upon as nearly as possible at the same time.

This joint action places all bidders for national forest timber on an equality and enables the organizers of pulp and paper enterprises to have equal assurance in regard to both timber supply and water power during the period of investigation and plan making when the expenditure of considerable sums of money is necessary.

ROADS AND TRAILS.

From January 1, 1922, to June 30, 1923, greater progress was made in road and trail work on the national forests than in any preceding period of the same length. The following table shows the accomplishments during the fiscal year 1923 and the total accomplishments and expenditure to the close of that year:

Construction, improvement, and maintenance of roads and trails from forest road appropriations and other Federal and cooperative funds, by States.

State.	Fiscal year 1923.		Total to June 30, 1923.				Expenditures to June 30, 1923.		
	Constructed.		Constructed.		Maintained.		Federal funds.	Co-operative funds.	Total funds.
	Roads.	Trails.	Roads.	Trails.	Roads.	Trails.			
	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*			
Alabama	10.0	.....	10.0	.....	10.0	19.0	$5,738.74	.....	$5,738.74
Alaska	19.1	40.6	90.2	96.7	133.2	96.7	895,613.19	$171,243.56	1,066,856.75
Arizona	136.7	313.8	465.6	993.8	578.1	506.8	1,305,519.38	660,725.20	1,966,244.58
Arkansas	29.6	62.3	108.5	133.4	66.8	267.3	302,644.32	24,184.93	326,829.25
California	140.5	463.5	462.7	1,211.2	1,540.7	5,029.4	3,478,506.08	978,348.99	4,456,855.07
Colorado	122.5	175.9	597.2	807.1	371.1	1,383.5	2,180,422.56	517,220.17	2,697,642.73
Florida	4.0	.....	42.4	.....	23.7	36.5	85,281.88	63,347.39	148,629.27
Georgia	5.0	34.0	13.5	69.4	10.0	114.6	127,583.32	.....	127,583.32
Idaho	206.7	647.4	958.1	1,946.7	380.6	5,071.0	3,431,191.47	891,895.01	4,323,086.48
Kansas	.....	.....	3.4	.....	.....	.....	2,111.51	.....	2,111.51
Maine	4.3	.....	4.3	30.0	7.1	32.3	10,344.08	.....	10,344.08
Michigan	.....	.....	40.4	.....	27.0	.....	6,318.98	186.95	6,505.93
Minnesota	25.0	.3	70.5	39.0	30.0	18.0	158,371.88	92,189.48	250,561.36
Montana	41.2	380.5	388.8	683.7	512.8	5,315.8	1,893,354.73	354,786.57	2,248,141.30
Nebraska	10.5	.....	24.6	.....	2.0	.....	18,043.86	.....	18,043.86
Nevada	3.0	143.3	299.3	340.8	142.7	82.0	261,411.65	98,163.46	359,575.11
New Hampshire	6.6	22.1	11.1	258.1	31.7	237.3	39,351.68	220.25	39,571.93
New Mexico	59.2	403.8	293.9	870.7	220.3	860.8	1,191,822.38	191,264.71	1,383,087.09
North Carolina	11.0	70.8	61.9	110.9	41.5	347.1	202,727.60	34,056.37	236,783.97
North Dakota	.....	.....	1.0	.....	.....	.....	65.75	.....	65.75
Oklahoma	3.0	.....	6.0	.....	19.0	.....	14,488.95	1,937.36	16,426.31
Oregon	395.4	354.3	1,147.4	944.6	1,341.3	3,507.0	3,421,762.02	2,080,008.66	5,501,770.68
Porto Rico	.....	14.0	.....	30.3	.....	30.3	8,672.64	.....	8,672.64
South Carolina	2.0	4.0	5.1	4.0	22.8	.....	50,432.32	11,900.00	62,332.32
South Dakota	34.4	.....	132.1	20.6	74.6	3.3	293,330.71	114,201.31	407,532.02
Tennessee	.....	105.2	12.2	151.7	11.0	281.2	103,872.97	80,050.00	183,922.97
Utah	472.6	279.0	801.1	740.0	485.7	651.0	1,216,473.65	624,262.31	1,840,735.96
Virginia	17.4	102.2	24.5	158.9	130.8	364.7	136,828.07	10,759.91	147,587.98
Washington	127.6	335.3	367.6	674.8	380.4	3,762.0	2,339,951.03	912,105.45	3,252,056.48
West Virginia	.....	20.5	.....	20.5	36.5	143.5	4,913.25	500.00	5,413.25
Wyoming	136.9	150.7	430.3	338.4	611.5	917.5	1,371,868.42	242,285.04	1,614,153.46
Total	2,024.2	4,123.5	6,873.7	10,675.3	7,242.9	29,078.6	24,559,019.07	8,155,843.08	32,714,862.15

In the calendar year 1922, 1,836 miles of road and 4,379 miles of trail were constructed or improved, and 5,525 miles of road and 23,107 miles of trail were maintained. For the calendar year 1921 the corresponding figures were 1,104 miles of road construction and improvement, 2,959 miles of trail construction, 3,007 miles of road maintenance, and 4,294 miles of trail maintenance. The progress on the small road projects and on the trails constructed under the direct supervision of the Forest Service has been much more rapid than on the larger, more difficult and expensive projects under the supervision of the Bureau of Public Roads. This is not at all surprising. The minor roads work of the Forest Service embraces numerous small projects scattered among many forests; the work is simple; very little time is required for surveys and preliminary estimates; and construction work can be carried on rapidly. Also these projects are handled entirely by day labor.

The projects supervised by the Bureau of Public Roads and approved from the 1922 and 1923 fiscal year appropriations have now in very large measure passed the survey and preliminary stages, and the coming year will show greater results in construction and a greater expenditure than in any preceding year. Some increase in

the minor work is also to be expected, but as now carried on it is close to the maximum possible under the present appropriations.

The following tabulation shows the condition of the five forest-road appropriations on July 1, 1923:

Condition of road appropriations on July 1, 1923.

	Total appropriations to June 30, 1923.	Total expenditures.	Unexpended balance.
Ten per cent	$3,541,840	$2,985,211	$556,629
Section 8	7,000,000	5,492,281	1,507,719
Federal forest-road construction	9,000,000	8,494,643	505,357
Forest highway	9,500,000	2,855,589	6,644,411
Forest development	5,500,000	3,376,143	2,123,857
Total	34,541,840	23,203,867	11,337,973

The distribution among States of the appropriations available for expenditure prior to July 1, 1923, and of the appropriations which on that date were made available for expenditure or against which obligations may legally be incurred is shown in the following tabulation:

Distribution among the States of the total appropriations and of the apportionment for the fiscal year 1924.

State.	10 per cent fund.		Section 8 fund.		Federal forest road construction fund total.	Forest highway fund.		Forest development fund.		Grand total.
	Fiscal year 1924.	Total.	Fiscal year 1924.	Total.		Fiscal year 1924.	Total.	Fiscal year 1924.	Total.	
Alabama	$85.96	$358.48	(1)	$60.00	$737.37	$2,044	$6,924	$3,104	$8,903	$16,982.85
Alaska	6,311.35	80,270.08	$43,764	376,500.75	204,980.50	361,046	1,331,317	25,626	75,848	2,067,907.06
Arizona	42,331.19	404,365.97	54,854	481,836.75	467,556.56	217,759	815,948	138,346	419,068	2,584,053.00
Arkansas	3,806.86	53,960.38	9,633	153,478.72	131,678.65	25,305	95,670	37,798	110,371	545,158.75
California	127,335.87	607,635.20	126,617	1,169,534.56	1,180,186.98	533,915	1,994,786	347,724	1,051,546	6,003,688.74
Colorado	46,496.58	391,048.78	67,814	607,373.61	788,579.96	263,748	980,806	171,548	507,908	3,275,517.69
Florida	1,824.33	18,129.94	(2)	15,392.86	4,552.07	9,105	34,223	4,490	13,220	85,517.87
Georgia	706.08	3,373.67	(1)	517.68	8,983.26	4,989	18,344	10,578	30,925	62,143.61
Idaho	59,482.35	466,904.71	113,793	943,548.04	1,388,598.21	394,829	1,492,723	589,402	1,678,058	5,969,338.46
Kansas		1,867.27								1,867.27
Maine	202.50	964.12	(1)	169.01	3,729.79	988	3,748	2,426	7,180	15,790.92
Michigan	49.43	790.77	(2)	15.00	3,000.00	1,828	5,466	3,376	9,596	18,867.77
Minnesota	1,075.32	14,557.44	(2)	7,637.65	110,374.80	23,655	84,584	21,918	87,539	304,792.89
Montana	39,239.38	388,390.90	65,215	602,074.00	758,553.19	317,192	1,196,078	405,084	979,699	3,925,223.61
Nebraska	1,731.99	11,812.19	(2)	26.98		4,003	15,068	5,466	16,625	43,532.17
Nevada	11,331.92	100,382.13	17,668	157,486.05	82,822.66	75,915	283,899	13,702	69,079	693,668.84
New Hampshire	2,541.39	12,387.19	(1)	181.10	10,784.46	12,504	47,798	12,772	37,048	108,198.75
New Mexico	17,894.75	239,970.59	38,124	344,935.51	521,904.39	164,330	622,588	94,816	314,468	2,043,866.66
North Carolina	3,364.01	16,294.47	(1)	91,741.49	30,208.66	10,391	38,247	24,798	71,782	248,273.62
North Dakota		45.75		15.00						60.75
Oklahoma	654.27	5,295.87	(2)	49.45	2,753.75	2,024	7,669	4,734	13,498	29,266.07
Oregon	67,244.78	442,896.00	136,587	1,119,770.80	1,091,284.66	453,395	1,610,504	440,922	1,159,477	5,423,932.46
Pennsylvania			(1)			1,189	1,189	9,208	9,208	10,397.00
Porto Rico		3.70	(2)	15.00	3,336.11	521	1,975	2,734	8,078	13,407.81
South Carolina	70.48	374.94	(1)	188.70	48,275.94	586	2,158	4,712	13,416	64,413.58
South Dakota	9,919.66	77,849.58	7,497	67,751.41	79,864.55	27,563	105,116	11,200	75,339	405,920.54
Tennessee	1,295.06	8,526.62	(1)	59,758.11	30,001.96	7,102	27,998	12,442	35,685	161,969.69
Utah	27,060.06	242,964.59	38,447	357,310.39	475,034.98	135,056	506,832	62,872	227,130	1,809,271.96
Virginia	2,502.99	14,453.71	(1)	2,599.80	5,686.58	10,657	36,797	24,660	71,172	130,709.09
Washington	34,497.55	246,646.31	85,880	767,900.19	727,323.83	259,269	967,402	381,432	984,381	3,693,653.33
West Virginia	208.17	1,686.58	(1)	128.64	2,225.80	3,561	9,612	7,782	22,384	36,037.02
Wyoming	28,304.78	216,200.75	45,410	369,637.21	561,245.97	175,531	654,531	124,268	391,369	2,192,983.93
Group 1			13,734	13,734.00						13,734.00
Group 2			34,963	34,963.00						34,963.00
Special fund			100,000	253,668.54						254,613.37
Equipment and administration					275,734.36					280,685.55
Total	528,569.06	4,070,403.68	1,000,000	8,000,000.00	9,000,000.00	3,500,000	13,000,000	3,000,000	8,500,000	42,570,409.68

[1] Group 2.

[2] Group 1.

By the post office appropriation act of June 19, 1922, Congress authorized a forest-road appropriation of $6,500,000 for the fiscal year 1924 and an equal amount for the fiscal year 1925. Of the $6,500,000 authorized for the fiscal year 1924, only $3,000,000 was directly appropriated. However, the Secretary of Agriculture was authorized to apportion the remaining sum of $3,500,000 and to incur obligations against this apportionment.

This constitutes a departure from the previous policy of Congress in appropriating for forest roads and trails. The intent of the legislation is to reduce the amount of undisbursed balances while still permitting work to proceed on the same scale as if the entire $6,500,000 had been directly appropriated. In effect, the total of $6,500,000 is guaranteed, but of this only $3,000,000 is made available for actual expenditure. While it is possible to carry the work on for a limited period under this installment method of making appropriations by drawing in the balances from all road funds in the States where construction has proceeded slowly for one reason or another, it is evident that sooner or later either supplemental amounts must be appropriated outright or the scale of work more than cut in half. This will actually come about not later than July 1, 1924. By that date no further road projects can be programmed or contracted unless additional appropriations taking up substantially the authorizations carried by the act of June 19, 1922, are made.

MAPS AND SURVEYS.

Forty-three maps of individual national forests on various scales were compiled and drafted by the Forest Service and printed during the fiscal year for administrative use. A number of forest maps were also used for recreation folders, which, with printed information and fire precautions on the reverse side, are issued to the public.

More rapid mapping and surveying of the national forests would greatly assist in fire detection and protection. Approximately 60,000,000 acres—about 33 per cent of the gross area of the forests—are sufficiently well surveyed and mapped to afford adequate assistance in planning and organizing fire protection, leaving 67 per cent of the area greatly in need of further surveys. Of the 146 forests, 47 are entirely without surveys which can be classed as good, 49 forests have less than 50 per cent of their area covered by good surveys, and the remaining 50 forests have from 50 per cent to 100 per cent of their area covered by adequate surveys.

RESEARCH.

TIMBER-GROWING INVESTIGATIONS—FOREST EXPERIMENT STATIONS.

Only by intensive management on all the forest lands in the United States can timber production be increased sufficiently to meet our requirements. The wolf will not be driven from the door until four times our present growth of wood is secured. Forest investigations are necessary to develop the technical practices by which this can be done, and forest experiment stations are the cutting edge of the investigative organization in this field. They have a very concrete part to perform in the program of national forestry—to increase our

timber growth from the 14,000,000,000 cubic feet possible under crude methods to the maximum obtainable from the same land by intensive forestry.

A forest experiment station is a group of investigators trained in forestry with headquarters at some central point where facilities for scientific work are available and with a dozen or more field stations located in the principal forest types of the surrounding region. Many of these field stations are placed on private lands under cooperative agreements with the owners. They include nurseries and demonstration plots, where the costs and possibilities of tree planting are worked out; sample thinning and felling areas, where various methods of cutting and natural reseeding are tested; and other plots where accurate measurements are carried on to determine the growth rate of important commercial trees and the yields of wood from stands of different ages. Slash disposal, the protection of forests from fire and other destructive agencies, and the relation between forests and stream flow are also covered in the work plans of forest experiment stations.

The importance of such research is realized when we recall that our annual forest fire loss amounts to over $16,000,000; that we have 81,000,000 acres of denuded and nonrestocking forest lands, a large part of which will require planting; that by managing our forests intelligently we can increase their growth of wood four and one-half times; and that the primary industries which depend upon forests for their raw material have an annual product of $2,500,000,000. The importance of the great interests at stake has led the Forest Service to urge the establishment of forest experiment stations in each of the important timber-producing regions of the United States.

As a part of this general program, two new stations, one in the Northeast and one in the Lake States, began work shortly after July 1 of this year, as a result of the appropriation made by the last Congress. These stations are on a more nearly adequate scale than any of those previously established, both as to personnel and as to equipment. Each of them is regional in character. The northeastern station is studying the forest problems of New England and New York; the Lake States station, those of Michigan, Wisconsin, and Minnesota. The work will be carried on chiefly at several field centers representative of large areas of forest in each region. The stations are first of all familiarizing themselves with the work already under way and developing cooperation with local agencies in the field, so that the investigative work in the region may be coordinated and unified to the advantage of all the forest interests.

Many of the problems which the forest experiment stations study are closely related to those which form part of the work of the agricultural colleges and experiment stations. Joint study with the agricultural colleges and experiment stations of related problems of climate, soil, plant growth, and the economics of land use is obviously desirable. Accordingly, in establishing the headquarters of the two new forest experiment stations cooperation with agricultural colleges in their regions has been arranged for.

Good progress was made during the year in the other regions. Studies of fire damage and of the relation between fire hazard and weather conditions in the Northwest, in California, and in the

Appalachian region contributed valuable information which has resulted in more effective fire protection and promises to lead to further valuable findings. A thorough study by the Appalachian station of the forest plantations on the Biltmore estate in North Carolina, the oldest and most extensive plantations in the region, has furnished an important contribution to the knowledge of species and methods of reforestation in that region. A comprehensive study of the growth of the southern pines by the Southern Forest Experiment Station, in cooperation with the National Research Council and several State forestry departments, is now nearing completion and will furnish much-needed information for the timber owners throughout the South who are seriously considering the continuous production of timber on their lands. The results of several outstanding pieces of research were published during the year.

In furtherance of its program the Forest Service plans, whenever the necessary funds can be made available, to enlarge the small-scale work now under way in the Pacific Northwest and in California by the establishment of stations on the standard set by the last Congress for the Lake States and the Northeast. These two western regions contain 50 per cent of the entire stand of saw timber left in the United States, and cut 10,355 million feet of lumber annually, or 31 per cent of the entire cut of the country. From 1915 to 1922, the lumber production of these regions increased 56 per cent, while the total cut in the rest of the country decreased over 30 per cent. Their 60,000,000 acres of forest land is more than the entire forest area of the Middle Atlantic and New England States from Maryland north. Under intensive forest management the three States of Washington, Oregon, and California should produce together an annual growth of 18,000,000,000 board feet, or over 25 per cent of that possible in the entire United States.

At the present time fire is the greatest single factor retarding the successful practice of forestry on the Pacific coast. Thousands of acres of mature timber are destroyed annually; but, what is much more harmful from the standpoint of our future timber supply, a much larger area of cut-over and restocking lands is being burned. It is essential that better methods of forest-fire control and suppression be perfected. We need more adequate knowledge of the climatic conditions which create dangerous fire hazards and the means of predicting their occurrence. Already a start has been made upon such studies, but much additional information is needed before remedial measures can be definitely prescribed.

Close to 3,000,000 acres in the three Pacific Coast States will require reforestation to make them productive. They will produce heavy stands of timber in 50 years' time. Better methods of forest planting, including the technique of nursery practice for our many species, sites, and forest types, must be developed. Again, agriculture in much of the region is largely dependent upon an abundant water supply for irrigation. In many sections the conservation of water supply and the prevention of erosion through intensive forest management and tree planting are necessary.

No industry can maintain itself without fundamental research, and this applies as much to lumbering as to agriculture or mining. In the older countries of Europe forest research has been under way for

scores of years and has made possible the present productiveness of their forests. Similar research work in this country is a necessity, and no time should be lost in getting it started in every important forest region. When the forest experiment stations have been built up to the size that the regions in which they are located justify they will return their cost in the future production of timber supplies manyfold. The widespread recognition of the necessity for research work through the medium of such stations shows that the country is alive to the importance of growing the timber crops necessary to meet our many and varied requirements.

FOREST PRODUCTS INVESTIGATIONS—FOREST PRODUCTS LABORATORY.

The Forest Service has devoted much attention to the problem of finding raw material for pulp and paper. If existing conditions continue, no other fibrous material can replace wood to any great extent in paper manufacture. This conclusion has been reached after the investigation of many of the most promising substitutes, notably waste from plant crops. The main effort of the Forest Service is therefore being directed to adapting pulping processes to more kinds of wood. Only five or six out of a hundred or more commercial timbers in the United States now find extensive use in pulp and paper making. Spruce, fir, and hemlock constitute 78 per cent of all the pulpwood now consumed, and relatively small supplies of these woods are left within reach of the existing pulp mills in the Northeastern and Lake States.

Forest Products Laboratory experiments with about 90 of the little-used species have shown that a number of them can be pulped satisfactorily. The discovery made two years ago that the pines of the Southern States could be made into high grades of white paper without radical changes in mill practice has already been adopted commercially to some extent, releasing corresponding quantities of spruce for newsprint. The same series of pulping trials helped to attract the attention of pulp mills in the Lake States to jack pine by showing the possibilities of this wood as a substitute for hemlock, at present the chief source of sulphite pulp in this region. The pulping of jack pine has also been accomplished on a laboratory scale by semikraft process, which produces a pulp suitable for the manufacture of high-grade container board. The same process is adaptable to other species and offers possibilities in utilizing lumber mill waste, especially from long-fibered resinous woods, including southern pine and possibly Douglas fir.

An enlargement of the raw material for newsprint manufacture, a critical problem now faced by the United States, is foreseen in other experiments under way at the laboratory. It was found that by a certain mild chemical treatment wood could be pulped with a yield as high as 80 or 90 per cent—double that heretofore obtained by any chemical pulping process—and that the product could be made directly, without bleaching, into a paper similar to newsprint. Hardwoods in particular respond favorably to this treatment, indicating that it may become feasible to manufacture newsprint from woods very different in character from the few now employed in the ground-wood process. The pulping is accomplished without the excessive power required to produce ground-wood pulp. If this

process can be perfected and used commercially, it will greatly extend the life of pulp mills where they now exist and will aid materially in the establishment of the industry in new regions.

Research has recently produced the long-sought cheap preservative to spray on ground-wood pulp to prevent its decay during storage. Infection of pulp by fungi entails a triple loss—the total loss of pulp that is too badly decayed to use, the cost of sorting out this pulp, and the reduction in yield and quality of paper through the use of partly decayed material. Such losses amount to $6,000,000 annually at ground-wood mills. After two years of experimenting with various antiseptics, the laboratory provided the industry with several preservatives that were considered economical enough to use, and very recently found, in a mixture of cymene and naphthalene, a preservative much cheaper than any tried before. This mixture sprayed on ground-wood pulp stored in a damp fungous pit kept it fresh and clean for 10 months, while untreated pulp was rendered useless. The cost of the treatment is less than 50 cents a ton. Some mills are now spending as much as $2.75 a ton simply to sort out decayed from sound pulp.

For some time the Forest Products Laboratory has been collecting data necessary to the formulation of universal grading rules for lumber. In May, 1922, a general meeting of manufacturers and other interested groups was held in Washington under the auspices of the Department of Commerce to discuss lumber standardization. Various groups of manufacturers, wholesalers, retailers, and consumers have organized themselves, with the assistance of the Departments of Commerce and Agriculture, to prosecute the standardization of lumber grades and specifications to its ultimate conclusion.

In the meantime the Forest Products Laboratory had made a nation-wide survey of the conditions in lumber manufacture, distribution, and utilization, so that when representatives of the various lumber associations met in Madison, Wis., in July, 1922, it was able to present basic grading rules for softwood yard lumber and structural timbers. These rules were accepted practically in their entirety by the committee and also by an assembly of all interested in softwood lumber standardization held later in Chicago. A central lumber standards committee was appointed by this assembly, to act as a steering committee for lumber standardization activities and to induce the acceptance of the standards agreed upon by manufacturers and consumers.

The laboratory's nine basic grades for yard lumber unify the two dozen sets of grading rules of various lumber manufacturers' associations and the diverse specifications of wholesalers, retailers, consuming factories, railroads, departments of the Federal Government, States, and cities. The basic grading rules harmonize lumber manufactured in the various regions from the same or different species of wood into grades of equal quality intended for the same general purpose. Standard rules have also been developed covering the nomenclature of yard lumber, sizes for its principal forms (such as boards, flooring, drop siding, and finishing), and the grades for each of these forms.

The basic rules formulated by the laboratory for grading structural timbers cover all species that are used for structural purposes.

They are based on the factors affecting the strength of timbers, as determined by exhaustive tests, and are the only grades in existence to which accurate working stresses can be applied. Structural timbers have always been selected on the reputation of a species for strength, widely different working stresses being given to the same species in various building codes, usually without any limitation as to grade or quality. The result was sometimes dangerous—more often wasteful—construction. In most cases the new working stresses permit the use of smaller timbers, or fewer timbers, and so make possible the saving of much material.

In the latter part of 1922 the laboratory initiated studies of the grading of hardwood lumber and softwood factory lumber. When these are completed the four principal phases of lumber standardization will have been covered. Producers, distributers, and consumers of lumber can well afford to depart from past practices to the extent necessary to adopt this constructive and urgently needed improvement in the lumber trade.

Two years ago, with the general support of wood producing and consuming interests, the laboratory set out to ascertain the dimension stock requirements of all secondary wood-using industries to determine the most economical method of converting the log directly into the sizes required by these industries, to save waste through more extensive manufacture of small, clear pieces, should that prove possible, and to standardize and stabilize small dimension requirements. A year was devoted to determining the requirements of the chair industry, embracing 165 factories in all parts of the country. Some of the findings were: (1) The chair industry now uses about 16 per cent of its total wood requirements in the form of small dimension stock, but might use 78 per cent: (2) producing small dimension stock from lumber at the chair factory requires an average of 50 per cent more raw material than is used, and the final dimension cuttings cost one and one-half or two times the market price of the lumber delivered at the factory; and (3) one-third of the freight bill is on material wasted at the factory in the cutting-up process.

Subsequent studies of the dimension-stock requirements of the wood-turning, automobile, and general furniture industries, though not yet completed, point to the same general conclusions. Many small sizes of lumber will be standard for several industries. A program of small-dimension stock production, marketing, and use in all industries is practicable and logical, and will constitute an important step in the solution of the wood-waste problems of the timberland owner, lumber manufacturer, and fabricator of wood. It should be profitable to all the interests concerned, and particularly should extend the life of our diminishing hardwood supply.

In kiln drying, a series of experimental runs conducted last fall in the Northwest disclosed how to dry Douglas fir common lumber. A type of kiln that gives promise of performing this difficult drying is a new internal-fan, rapid-circulation kiln developed at the laboratory. Through the cooperation of the West Coast Lumbermen's Association, a commercial kiln located in the Douglas fir region was turned over to the Forest Service representatives, who remodeled it and conducted demonstration runs for three months. At the end of this time they had worked out a practical method of

drying common lumber, benefiting 40 per cent of the Douglas fir cut. A similar investigation on a larger scale was started in cooperation with the Southern Pine Association, where the annual losses due to improper drying of southern pine aggregate $10,000,000 annually. The practices of southern pine manufacturers in five States were surveyed and drying experiments conducted which showed how to eliminate most of their losses without additional expense.

The laboratory is continually bringing to light sources of waste and loss in the use of wood. In one sense practically all forest-products investigations are designed to reduce waste. Yet accurate statistics have been collected as to the extent of only a few of these losses. For preliminary research on the technical phases of a problem, it has been sufficient in most cases to know that the wastes were there and were of considerable proportions. One of the more recent undertakings of the laboratory is a more exact measurement of the wastes encountered in all of its field and factory studies and an assembling of this statistical information with the object of presenting a more graphic, comprehensive, and convincing picture of the present inefficiency in wood utilization. Such figures will make it possible to point out to the industries many losses that can be eliminated without further technical research, to determine more precisely the point to which refinement in factory processes may profitably be carried, and to lay out more certainly the future course of research in forest products. Waste in part unavoidable, but in part preventable, now amounts according to the best data available to about 41 per cent of the total volume of timber cut from the forests. The reduction of this waste is as essential a part of forest conservation as the prevention of forest fires or the growing of timber crops.

INVESTIGATIONS IN FOREST ECONOMICS.

The problems of timber supply and forest-land use in the United States are at bottom economic problems. One of the primary requisites of the present situation is detailed and accurate facts on present and future timber supplies and consumption, on forest-land use in relation to agriculture, on timber and forest-land taxation, on the transportation of forest products, on timber values, and on the prices of lumber and other forest products.

Enough is now known about many of these questions to make clear the broad lines along which action must be taken, but the public, as well as individual industries, is handicapped by the lack of specific information. The pulp and paper situation is a case in point. General information is available, but the detailed facts on pulpwood supplies in specified States and regions are so meager that it is exceedingly difficult for the Forest Service to give the industry satisfactory assistance in planning for its future.

One of the most important of these economic questions concerns the kind, quality, and distribution of existing timber supplies and their availability for various purposes. Exact knowledge is also needed on the present requirements of individual industries as to the amount and quality of timber. Such information will give permanency and stability to industries and safeguard the public against disastrous fluctuations and shifts.

A second important question concerns the area, location, and distribution of forest lands, their relation to agriculture, and how our productive land should be divided between agricultural and forest crops. The most economic and profitable use of land is the foundation both of agriculture and forestry.

For the guidance of private owners as well as public agencies authentic data are needed on lumber values and the costs and prices of a wide range of forest products. Stumpage values afford one of the best guides for the private owner in determining whether he can grow timber profitably in various parts of the country. He should have access to information showing the past history and trend of timber values and their bearing upon the returns to be expected from crops now being started. The cost of growing timber and the prices of its manufactured products have an equally important use in encouraging reforestation where it may soundly be undertaken.

As in agriculture, transportation is a factor of fundamental importance in the whole question of timber growing. Transportation costs from the present sources of supply may be the decisive factor in deciding whether timber can be grown economically in any region. This question in its relation to timber supply and forest-land use has been studied but little and is only partially understood. Public as well as industrial welfare demands much more complete and accurate information than is now available.

Timber and forest land taxation is another factor of fundamental importance in private timber growing. The substitution of sound and stable methods of taxation for the common haphazard and unstable system of ad valorem land taxes will remove one of the chief obstacles to private forestry. While subject to State laws alone, research and leadership in the solution of forest taxation should be provided by the Federal Government.

The Forest Service now has a limited amount of work under way on several of these lines. It has been possible to make some study of the taxation question and to attempt the formulation of a timber and forest land-tax plan which will make timber growing feasible and at the same time meet the need of local communities for current revenue. A publication covering the information already secured is now in preparation. A preliminary study is being made of the transportation question with particular reference to lumber. A relatively small amount of data on stumpage values has been collected from time to time, and these also will be made available as soon as their character warrants. An investigation of the economic effects of forest fires and forest-land devastation in certain States has been under way for the past two years. An article in the department Yearbook for 1922, entitled "Timber: Mine or Crop?" prepared during the past year, is a summary of the more important data now available in the Forest Service bearing upon the economic problems of timber supply and forest-land use.

RANGE INVESTIGATIONS.

As a matter of business administration, it is quite as essential that the forage resources of the national forests be maintained at their maximum as that the timber resources be so handled. Each

is a national resource vital to large agricultural and industrial interests. The purpose of the grazing studies work is to learn the fundamental principles affecting the improvement and utilization of the ranges and to introduce better practical methods of use.

Fundamental range investigations require thorough study for a number of years in specific areas where all of the controlling factors can be closely determined. In recent years the Forest Service has conducted this class of work largely at the Great Basin Experiment Station in Utah and the Jornada and Santa Rita Range Reserves in New Mexico and Arizona.

Some of the important results of range investigations are:

(1) Systems of range management, especially deferred and rotation grazing, have been developed which maintain the forage resource and increase its carrying capacity.

(2) Studies of artificial reseeding have made the improvement of range areas possible where conditions are favorable to this intensive method.

(3) The determination of the proper seasons for grazing various types of forage has prevented too early grazing, which decreased the stand and caused weakening and losses of livestock.

(4) The open herding and bedding-out system of handling sheep is now in application on over 65 per cent of the national forest ranges and on many private holdings, with a resultant increase of from 15 to 20 per cent in the carrying capacity of the range.

(5) Practical methods have been determined for eradicating tall larkspur, water hemlock, death camas, and other poisonous plants. The eradication of tall larkspur on a number of selected areas by the Forest Service in cooperation with stockmen, at a total expenditure of less than $38,000, has resulted in a saving of over $65,000 in the annual loss of cattle.

(6) The most practical and efficient ways of developing water under the varying conditions of the Southwest, where adequate water on ranges is so important, have been carefully worked out.

(7) A practical system of cattle management for the semidesert ranges of the Southwest has been developed which permits satisfactory production and helps prevent excessive losses during drought periods.

In the 11 far Western States there are approximately 110,000,000 acres of grazing land within the national forests, nearly 175,000,000 acres of unappropriated and unreserved public domain suitable for grazing purposes, and over 350,000,000 acres of private and State lands and other Federal reservations which are capable of being grazed. Approximately 32 per cent of the sheep and 18 per cent of the cattle, exclusive of lambs and calves, in the 11 western range States are grazed upon national forest ranges during a part of the year. These ranges have since 1907 increased in productivity about 25 per cent, while the major part of the unreserved public ranges have been deteriorating until now they probably have not over half their original productivity. The increase in productiveness of the forest ranges has been due primarily to the fact that the range investigations have afforded a scientific basis for the management and utilization of the grazing resources and represents an increase of over $400,000 per annum in grazing receipts.

The open-herding and bedding-out system, together with other phases of better sheep management, has increased the weight of lambs coming from national forest ranges about 5 pounds each, which at a very conservative estimate means 10,000,000 pounds more on lambs each year. At a valuation of 7 cents per pound this amounts to approximately $700,000 each year clear gain to the lamb producers. An increase of from three to four million pounds of wool has resulted from these improved methods. The application of improved methods in handling cattle on national forest ranges has increased the number and weight of cattle grazing thereon and the number of calves produced, and has decreased the losses to such an extent that compared with 1907, when the range investigations were started, the increased production of beef from national forest ranges has been conservatively estimated at 40,000,000 pounds. The extension of improved management should increase these figures materially.

These results on the national forests stand out in contrast to those being obtained on the open public domain, where lack of regulation prevents the application of satisfactory management. Regulation of the unreserved public domain would make possible a better control of the spring, fall, and winter ranges and would remove one of the greatest handicaps to stability in the livestock industry.

The range investigations have been made with an annual expenditure never exceeding $35,000. It has been impossible to study all the problems of range management in the West. Vegetative conditions are so different and the controlling factors of climate, growth, and range management so varied that adequately to cover the situation and needs will require additional investigations of the problems peculiar to ranges at different elevations and to individual regions. This work deserves extension at the earliest date possible.

GRAZING RECONNAISSANCE.

Grazing reconnaissance is being extended as rapidly as funds will allow. During the year a total of 1,970,000 acres on the Beaverhead, Deerlodge, Helena, Montezuma, Santa Fe, Fillmore, Caribou, Minidoka, Modoc, and Shasta National Forests were covered by grazing specialists and management plans developed. This makes a total of over 20,000,000 acres of national forest lands on which range reconnaissance has been conducted. The value of this work lies in the more specific knowledge obtained of the grazing resources.

EXTENDING TECHNICAL GRAZING KNOWLEDGE.

Special efforts have been put forth in recent years to train a corps of grazing specialists within the national forest organization and to instill a better understanding of range management in all forest officers and grazing permittees. Every new technical grazing man is given a course of practical training under the guidance of experienced men already in the organization. Considering the importance of the livestock industry dependent upon the national forests and its value to the West, there is serious need of enlarging the technical grazing personnel of the service.

COORDINATION OF GRAZING STUDIES WORK.

The correlation of all grazing studies work in the western range States has been strongly emphasized. Plans for cooperative investigations by the Forest Service and a number of State agricultural experiment stations have been worked out. A cooperative study of the spring, fall, and winter sheep ranges jointly by the Bureau of Animal Industry and the Forest Service has been started at the United States sheep experiment station of the former bureau at Dubois, Idaho. The Forest Service has assisted in the range extension program which the Department of Agriculture is developing in cooperation with the Western States Extension Service. This program should develop closer coordination of the extension work with that of the Forest Service in the study and application of improved range management.

INFORMATIONAL AND EDUCATIONAL ACTIVITIES.

The forest problem of the United States is in an important sense a problem of public education. The private owners, especially the great number of small owners, should know what prospect of profit timber growing holds out, how to market salable material to the best advantage, how to cut so as to secure regrowth of the right kind, and how to restore run-down forest and idle land to good productive condition. The introduction of new practices in land use must overcome a tremendous inertia due to unfamiliarity and hesitation to embark on a course not fully charted by custom and experience. Wood-using industries and consumers alike need to be educated in the most economical and advantageous use of wood. The general public needs thorough education in the prevention of forest fires of a kind that will change ingrained habits—no light or simple task. The public should also have an intelligent grasp of the reasons why forest conservation is necessary from the standpoint of local and national welfare, how it is practiced, and what part the public should take in promoting it. The educational task in forestry is of an importance fully equal to any that is presented by the whole great problem.

The Forest Service is endeavoring to carry the responsibilities resting upon it in this field to the extent that available resources permit. As public interest in forestry grows the openings multiply. There is particular need for more vigorous and better organized effort in cooperation with local agencies of various kinds to aid State forestry movements and for extension work to bring forestry into much wider practice through demonstration methods that can be observed and copied locally.

Among the means employed may be specified publicity through the departmental press service, readable popular publications, talks and illustrated lectures, the circulation of sets of lantern slides and lecture outlines and of a few small traveling exhibits, chiefly for use by teachers, the making of exhibits and educational motion pictures under general departmental plans, and the building up of collections of high-grade illustrative material—photographs, lantern slides, etc. At the Forest Products Laboratory much attention is given to extension work in the industrial uses of wood through short educational

courses conducted at the laboratory and in other ways. A special effort is made to give help to teachers in introducing more forestry into their educational work, but the opportunities along this line are enormously beyond the equipment of the service.

A large obligation rests upon the service to educate the public in forest protection, since two of the largest expenditures of the service are to prevent forest fires on the national forests and, in cooperation with States, on private and State forest lands. While organized systems for the suppression of fire will always have to be maintained, a major part of the task of bringing about adequate protection is educational; and merely organizing to put out fires without endeavoring to obtain the cordial cooperation of the public for their prevention and control would be an undertaking of hopeless futility.

The field force of the Forest Service has thrown itself into the task of public education in forestry with ardor, intelligence, and striking success. To them, of course, the matter comes home in a most practical way; without the interest of the public in their work, a fair understanding of its direct value, and a disposition to cooperate, the task of successful administration and protection would be well-nigh impossible. Down to the forest rangers, and by no means least on the part of the rangers, the forest force has become a powerful agency for spreading the gospel of protection among the public and for making known the nature and purposes of the public enterprise in forestry. The results have been of very great value. Use of the national forests is increasing by leaps and bounds, but the fire hazard does not correspondingly increase—if anything, it gives evidence of growing less.

The interest of the forest personnel in fire prevention through education has reached the point where a demand is coming from the men for material that they can use in talks before schools, small meetings, commercial and civic bodies, and the like. Lantern and motion-picture equipment is being asked for from the field at a rate decidedly beyond the capacity of the service to supply. Indeed, there are almost unlimited possibilities for the use of educational material, through all sorts of agencies, if an adequate supply were available. The educational work of the service should be much more amply provided for than it ever has been. It is capable of making very great returns on the outlay.

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